MONTHLY WEATHER REVIEW.

Editor: Prof. Cleveland Abbe. Assistant Editor: H. H. Kimball.

Vol. XXXI. APRIL, 1903. No. 4

INTRODUCTION.

The Monthly Weather Review for April, 1903, is based on data from about 3300 stations, classified as follows:

Weather Bureau stations, regular, telegraph and mail, 160; West Indian service, cable and mail, 8; River and Flood service, 52, river and rainfall, 177, rainfall only 62; voluntary observers, domestic and foreign, 2565; total Weather Bureau Service, 2962; Canadian Meteorological Service, by telegraph and mail, 20, by mail only, 13; Meteorological Service of the Azores, by cable, 2; Meteorological Office, London, by cable, 8; Mexican Telegraph Company, by cable, 3; Army Post Hospital reports, 18; United States Life-Saving Service, 9; Southern Pacific Company, 96; Hawaiian Meteorological Service, 75; Jamaica Weather Service, 130; Costa Rican Meteorological Service, 25; The New Panama Canal Company, 5; Central Meteorological Observatory of Mexico, 20 station summaries, also printed daily bulletins and charts, based on simultaneous observations at about 40 stations; Mexican Federal Telegraph Service, printed daily charts, based on about 30 stations.

Special acknowledgment is made of the hearty cooperation of Prof. R. F. Stupart, Director of the Meteorological Service of the Dominion of Canada; Mr. Curtis J. Lyons, Territorial Meteorologist, Honolulu, H. I.; Señor Manuel E. Pastrana, Director of the Central Meteŏrological and Magnetic Observatory of Mexico; Camilo A. Gonzales, Director-General of Mexican Telegraphs; Capt. S. I. Kimball, Superintendent of the United States Life-Saving Service; Lieut. Commander W. H. H. Southerland, Hydrographer, United States Navy; H. Pittier, Director of the Physico-Geographic Institute, San José, Costa Rica; Commandant Francisco S. Chaves, Director of the Meteorological Service of the Azores, Ponta Delgada, St. Michaels, Azores; W. M. Shaw, Esq., Secretary, Meteorological Office, London; Rev. Josef Algué, S. J., Director, Philippine Weather Service; and H. H. Cousins, Chemist, in charge of the Jamaica Weather Office.

Attention is called to the fact that the clocks and self-registers at regular Weather Bureau stations are all set to seventy-fifth meridian or eastern standard time, which is exactly five hours behind Greenwich time; as far as practicable, only this standard of time is used in the text of the Review, since all Weather Bureau observations are required to be taken and recorded by it. The standards used by the public in the United States and Canada and by the voluntary observers are believed to conform generally to the modern international system of standard meridians, one hour apart, beginning with Greenwich. The Hawaiian standard meridian is 157° 30′, or $10^h\ 30^m$ west of Greenwich. The Costa Rican standard of time is that of San José, $0^h\ 36^m\ 13^s$ slower than seventy-fifth meridian time, corresponding to $5^h\ 36^m$ west of Greenwich. Records of miscellaneous phenomena that are reported occasionally in other standards of time by voluntary observers or newspaper correspondents are sometimes corrected to agree with the eastern standard; otherwise, the local standard is mentioned.

Barometric pressures, whether "station pressures" or "sea-level pressures," are now reduced to standard gravity, so that they express pressure in a standard system of absolute measures.

FORECASTS AND WARNINGS.

By Prof. E. B. Garriott, in charge of Forecast Division.

Over northwestern continental Europe unusually severe weather during the first and second decades of the month culminated on the 19th and 20th with gales, snow, and low temperature over Germany, northern Russia, and the Scandinavian Peninsula.

During the first and third decades of the month several storms of moderate strength advanced from the Atlantic Ocean over the British Isles, those of the first decade passing to the north, and those of the third decade over the southern part of Great Britain.

Storms.—On the 3d and 4th, and from the 14th to the 17th, stormy weather prevailed along the middle and north Atlantic coasts of the United States, and during the latter period northeast gales of 40 to 60 miles an hour detained many vessels in north Atlantic ports. The gales of the Gulf of Mexico and the Pacific coast were not severe. On the 3d a well-defined storm, with snow and low temperature, swept from the upper Lake region over the Ohio Valley and New York, and from the 12th to 14th, and on the 29th and 30th, stormy weather prevailed in the Lake region. Ample and timely warning was given of the approach of all storms that visited the sea coasts and Great Lakes of the United States.

Cold waves.—The most important cold wave of the month set in over the northern Rocky Mountain and Plateau districts on the 27th, extended over the Northwestern States, with snow from the northern Plateau over Wyoming and Montana during the 28th, and on the 29th covered the Middle-western and Northwestern States, with snow in Wyoming, Colorado, South Dakota, and Nebraska. At the close of the month this cold wave extended from the upper Lake region over the upper and middle Mississippi Valley and the Southwestern States, with freezing temperature to northwestern Texas, and snow in the upper Lake region, Iowa, Missouri, and Illinois.

Frosts.—The following press comments have been made regarding the warnings of frost and freezing weather that were issued during the month:

Macon, Ga., Telegraph, April 6, 1903:

As predicted, Georgia, the interior of Alabama and of Mississippi were visited by frosts yesterday morning—light, however, except in exposed places, and where the breeze was less. The warnings issued by the Weather Bureau were generally heeded, and much was done to save flowers and small garden truck of tender varieties.

Wilmington, N. C., Star, April 7, 1903:

Reports are conflicting as to the extent of the damage to truck crops in this section by reason of Saturday and Sunday's cold snap. The timely warning issued early by the Weather Bureau and its rapid dissemination by the railroads and others no doubt reduced the injury to a minimum, but the damage, of course, was something.

Newbern, N. C., Journal, April 10, 1903, editorial:

The recent freezing weather through which the truck crops of this vicinity passed and escaped destruction, suffering but little damage, is a matter of more than mere congratulation, it is a blessing for which every one is profoundly and truly thankful.

The natural climatic conditions of this section for early truck crops, and for that matter for all crops throughout the year, together with favorable soil conditions, place the agriculturists of this section most advantageously in position to make good crops when other sections are afflicted with adverse conditions.

An important factor of assistance to the farmers in this vicinity is the Weather Bureau service, with its forecasts of weather changes.

At all seasons this service is found of great benefit, and at no time has it proven more valuable than in its forecasts of last week, forecasting the severe weather change and great fall in temperature, enabling the truckers to make all possible efforts to offset the impending frost or freeze.

While this section, as already stated, suffered little from the freezing weather, the Weather Bureau warning made it possible for the truckers to take many precautions which without the forecast they would not have taken.

That the Weather Bureau service is of incalculable value to the farmers of this section every one will bear ample and full testimony. Its reports are eagerly looked for and its forecasts are heeded, every farmer being an inquirer during the season as to what the daily forecast may be.

The Daily States, New Orleans, La., May 1, 1903:

The warnings of the United States Weather Bureau for these frosts, although so much out of season, have been, as usual, exceptionally accurate. They were so timely as to enable protection of the extensive and valuable truck farming interests of the Southwest, which means the saving of thousands of dollars to this industry.

The Daily Picayune, New Orleans, La., May 2, 1903:

This is perhaps the most general and severe frost that has ever visited the Southwest so late in the spring. Just what the effects will be on the general crops can not be even conjectured. Trucking interests, which have reached enormous proportions during recent years in Louisiana and Texas, are likely to suffer the greatest damage from such unseasonable frost, as it is impossible at this time to protect all crops. However, the accurate warnings issued by the United States Weather Bureau were, through its complete and perfect system of distribution, placed in the hands of every truck-growing community which was threatened with frost by 9 a. m. Thursday, and this gave the growers time to protect extensively. Thus, the Weather Bureau has again saved the farmers of this section several hundred thousand dollars, as it has done in the case of every occurrence of severe weather in recent years. It is a notable fact that no severe weather makes its appearance without its approach being heralded by the ever-alert and efficient Weather Bureau forecasters.

In the latter part of the month the peach crop in southern Oregon was damaged by frost. The frost was accurately forecast, but protective measures are not generally employed in that section.

Flood.—At New Orleans the Mississippi River reached the highest stage of the flood of 1903, 20.4 feet on April 6 and 7, and for a few hours the stage was reported at 20.7 feet.

The Washington Post, of April 19, 1903, comments, editorially, as follows, regarding the work of the Weather Bureau:

The newspapers published in the lower Mississippi Valley pay high tribute to the Weather Bureau, acknowledging the accuracy of its predictions and their immense value to the people of that section. The New Orleans Times-Democrat says, for example:

"Before the organization of the old Signal Service, later changed to the Weather Bureau, the cane crop of Louisiana was frequently cut down one-half or three-fourths by the sudden descent of a freeze on the sugar district without a word of warning. To-day that is impossible. That problem in meteorology has been solved. The Weather Bureau may err in its 'probabilities' as to rain, but not as to a cold wave, and with telegraphic communication with the great Northwest, from which our cold weather comes, it is able to foretell the approach of a freeze four, five, and sometimes six days in advance. By the splendid system adopted for the dissemination of cold-wave signals, every planter in Louisiana is informed within a few hours of the prospective freeze, and is thus given ample time for preparation, and is able to windrow his cane or otherwise protect himself.

"We have been placed this year under another obligation to the Weather Bureau for its high-water news and predictions. It has kept the people of the lower Mississippi well informed of what they may expect in the way of high water, and its predictions have been subsequently verified by the facts."

It is easy for gentlemen in towns and cities, especially those who have no more than an idle and capricious interest in the weather, to sneer at the work of the Bureau when some of its least important forecasts fail of verification. An unexpected shower will interfere with the projected golf play or spoil a match of lawn tennis, and this is provocation enough for petulant and contemptuous criticism. But serious men engaged in serious occupations all over the country have cause to regard the Bureau as one of the most useful and beneficent of our Governmental institutions. Indeed, it is more than a mere utility maintained at the expense of the taxpayers; it is an agency of incalculable profit to the whole people. It saves each year to the shipping, the insurance, and the agricultural interests, and to scores of other interests, subordinate to or involved in them, more money than is required to maintain the Bureau itself a thousand times over. The producers, the toilers, the millions depending for subsistence upon our great national industries, have never made, and will never make an investment even distantly approaching this in the matter of opulent returns.

BOSTON FORECAST DISTRICT.

Storm warnings were issued on the 2d, 3d, 4th, 7th, 8th, 14th, 15th, 16th, 17th, and 30th. During the storm of the 14th to 17th a persistent northeaster prevailed and shipping was tied up for a period of from four to six days. Warnings were displayed from twelve to eighteen hours in advance of the storm, and to this information was doubtless due the absence of loss of life and wreck of vessels. The press and the public generally gave due credit to the Bureau for its good work.—*J. W. Smith, Forecast Official.*

NEW ORLEANS FORECAST DISTRICT.

Several disturbances of moderate intensity crossed the district during the month. High winds occurred at some stations along the Gulf coast on the 3d, 4th, 13th, 14th, 29th, and 30th, for each of which timely warnings were issued. Very little rain fell in many parts of the district. Conditions were such as to warrant forecasts for showers on several occasions, but only inappreciable rainfall occurred, except in isolated cases, until the 29th, when general showers and, in some sections, good rains fell, for which forecasts were issued.

The temperature was generally below the normal, and the month closed as one of the coldest on record. Cold wave warnings were issued for Oklahoma on the 29th; the temperature fell 28° and to a minimum of 32° on the 30th. Warnings for general frosts for the greater portion of the district and heavy and probably killing frosts in the northern portion were issued April 30. Heavy and in some places killing frosts occurred in the northern portion of the district, and frost was reported well southward on May 1. These warnings saved several thousand dollars to trucking interests.

The river reached its highest stage, 20.4 feet, April 6 and 7. For a few hours at a time the stage was reported at 20.7 feet. The break in the levee 40 miles above New Orleans, known as the Hymelia crevasse, has not been closed. The cribbing around the break was joined April 6, but 200 feet of this washed out during the 8th and 9th, and the water cut a channel 30 feet deep. All efforts to stop the flow of water through the crevasse have been unsuccessful, but the work has not been abandoned. The river has been falling slowly since April 8.—*I. M. Cline, Forecast Official*

CHICAGO FORECAST DISTRICT.

The regular season of navigation opened April 1, much earlier than usual. Several storms passed over the Lakes during the month and warnings were displayed with great frequency.

Southeast warnings were ordered in the afternoon of the 1st and changed to northwest in the morning of the 2d and to northeast in the morning of the 3d on Lakes Michigan and Huron. The storm advanced from the Rocky Mountain region with increasing force and caused high winds at nearly all stations on the 2d and 3d. Another storm developed in the west, for which southeast warnings were ordered on the upper Lakes at 6 p. m. of the 10th. Northeast warnings were ordered on Lakes Michigan and Huron at 10 a. m. of the 12th. They were changed to northwest warnings on the morning of the 13th and were continued for forty-eight hours. The storm moved very slowly and dangerous winds prevailed over the upper lakes for an unusually long period. Northwest warn-

ings were ordered on the 24th, and on the 28th northwest warnings were displayed on Lake Superior and northeast warnings on Lakes Michigan and Huron. The warnings were continued for forty-eight hours. This storm was not as severe as those which occurred earlier in the month. No wrecks of any kind were reported and it is thought that advantage was taken of the warnings in every case.

Unseasonably cold weather overspread the district during the latter part of the month and forecasts of freezing temperature were made on April 30 for the eastern and southern portions of the forecast district. The conditions were sufficiently severe to cause a flurry in the grain market, the prices rising decidedly as the result of the cold weather, as it was thought that considerable damage would be done.—*H. J. Cox, Professor of Meteorology.*

DENVER FORECAST DISTRICT.

Special warnings were issued well in advance of the cold snap that visited western Wyoming and Utah on the 2d and of the killing frost that occurred in western Colorado on the morning of the 5th. Warnings were also issued on the morning of the 10th for the killing frost that occurred in Utah on the 11th, and on the 29th for the severe freeze in southeastern Colorado and northern New Mexico. Vegetation was far advanced in the last-named districts and great damage resulted to fruit, gardens, etc.

Notices of light frosts were frequently included in the forecasts for such localities as the progress of vegetation warranted.—*F. H. Brandenburg, Forecast Official.*

SAN FRANCISCO FORECAST DISTRICT.

The month opened with a marked depression over Utah, accompanied by heavy rains over southern and central California, with snow in the mountains. The precipitation was also heavy in northern Arizona, the twenty-four hour rainfalls at Flagstaff on April 1 and 2 being 2.78 inches and 1.50 inches, respectively. In California, especially in the southern portion, rainfalls from 1 to 2 inches were recorded.

A persistent high off the coast of northern California and Oregon prevailed from April 2 to 9. A moderate depression over Nevada and Utah appears to have extended westward, overlying the Sierras and causing unsettled weather with showers generally in California on April 10.

The first reports from Southeast Farallon, 27 statute miles west of San Francisco, were received on April 17, a submarine cable having been successfully laid April 10 to 14.

Unsettled weather prevailed on April 16 and 17. At Los Angeles a twenty-four hour rainfall of 2.94 inches was reported on April 17. The remainder of the month was free from any marked disturbance.—*A. G. McAdie, Professor of Meteorology.*

PORTLAND, OREG., FORECAST DISTRICT.

In this district the month was dry and slightly cooler than usual, with no damaging storms. High winds occurred along the coast on the 6th and 7th for which warnings were issued in time to be of benefit to outgoing vessels.

During the latter part of the month frosts, which were accurately forecast, seriously damaged the peach crop of southern Oregon. Preventive measures, such as smudging, spraying, direct heating, etc., are not generally employed by horticulturists in this district and but few availed themselves of the opportunity presented by the warnings to protect their crops.—*Edward A. Beals, Forecast Official.*

AREAS OF HIGH AND LOW PRESSURE.

Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocity.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
High areas.		°	°		°	°	*Miles.*	*Days.*	*Miles.*	*Miles.*
I	3, p. m.	47	97	7, a. m.	47	60	2,450	3.5	700	29.2
II	11, a. m.	45	124	14, a. m.	41	101	1,225	3.0	408	17.0
III	13, p. m.	47	101	18, a. m.	37	83	1,775	4.5	394	16.4
IV	17, p. m.	38	123	20, p. m.	49	87	2,400	3.0	800	33.3
V	21, p. m.	41	105	24, p. m.	30	82	1,700	3.0	567	23.6
VI	21, p. m.	38	123	29, p. m.	27	80	4,250	8.0	531	22.1
VII	25, a. m.	38	123	28, a. m.	48	123	850	3.0	283	11.8
VIII	28, a. m.	53	108	29, a. m.	49	100	450	1.0	450	18.8
IX	29, a. m.	38	123	*2, a. m.	48	122	750	3.0	250	10.4
X	29, p. m.	41	105	*2, p. m.	47	60	2,600	3.0	867	36.1
Sums							18,450	35.0	5,250	218.7
Mean of 10 paths							1,845		525	21.9
Mean of 35.0 days										22.0
Low areas.										
I	1, a. m.	43	109	3, a. m.	49	69	2,000	2.0	1,000	41.7
II	2, a. m.	37	105	4, p. m.	45	66	2,250	2.5	900	37.5
III	3, a. m.	53	117	7, a. m.	49	89	1,950	4.0	488	20.3
IV	6, p. m.	32	106	9, a. m.	44	67	2,450	2.5	980	40.8
V	8, p. m.	42	118	15, a. m.	39	75	2,875	6.5	442	18.4
VI	16, p. m.	39	120	21, p. m.	32	65	3,300	5.0	660	27.5
VII	21, p. m.	51	120	28, a. m.	32	65	3,450	6.5	531	22.1
VIII	25, p. m.	51	120	27, a. m.	50	97	1,100	1.5	733	30.6
IX	29, a. m.	42	93	*1, a. m.	48	68	1,400	2.0	700	29.2
X	30, a. m.	51	120	*4, a. m.	47	71	3,000	4.0	750	31.2
Sums							23,775	36.5	7,184	299.3
Mean of 10 paths							2,378		718	29.9
Mean of 36.5 days										27.1

* May.

For graphic presentation of the movements of these highs and lows see Charts I and II.—*H. C. Frankenfield, Forecast Official.*

RIVERS AND FLOODS.

The stages of water in the Mississippi River were decidedly higher than during April, 1902, the excess ranging from 6 to 10 feet. Above the mouth of the Ohio the highest stages were due to the substantial and well distributed rainfall, while farther south the last of the flood waters of the preceding month of March passed slowly to the Gulf of Mexico, augmented by a moderate tide from the Ohio about the middle of the month. In fact, the crest of the flood of March, 1903, did not pass New Orleans until the 6th and 7th of April when a stage of 20.4 feet was reached, 4.4 feet above the danger line, and 0.9 foot higher than any previously recorded stage.

The arrival at St. Paul on the 14th of the steamer *Cyclone* marked the opening of through navigation on the Mississippi River for the season; it was seven days later than in 1902, when the same steamer was the first to pass through Lake Pepin.

Ice was last observed in the Missouri River on the 9th. Navigation at Pierre, S. Dak., was resumed for the season on the 6th, although the river was not entirely clear of ice until three days later. From the 5th to the 6th there was a rise at Bismarck, N. Dak., of 7 feet, of which the greater portion evidently came from the Yellowstone and Little Missouri rivers. The crest of this rise traveled steadily down the river, diminishing to about four feet by the time it reached Sioux City, Iowa, and to about two feet after leaving Kansas City, Mo. It reached St. Louis, 1330 miles from Bismarck, on the 18th.

The Illinois River continued above the nominal danger line throughout the month, the steady rains preventing any falls of consequence. No damage was reported.

Nothing of special interest occurred along the Ohio River, although the steady rains from the 7th to the 17th occasioned a sharp rise which was felt over the entire tributary district.

The crest of this rise passed Cairo, Ill., during the 22d to the 24th, but danger-line stages were not reached, except at Evansville, Ind., where the maximum stage was 36.1 feet on the 21st, 1.1 feet above the danger line. The necessary warnings were issued on the 18th, and the actual damage was limited to the overflowing of some lowlands that had been planted in corn. Farming operations, however, were greatly delayed, owing to the wet soil.

The Tennessee River fell during the first week of the month, immediately after which heavy rains set in, resulting in a general rise. Stages of from 2 to 3 feet above the danger lines were experienced from Florence, Ala., to the mouth of the river. Above Florence the rise, while very marked, was not at all dangerous. General warnings which were issued on the 8th proved to be of great value. Near Riverton, Ala., 40,000 railroad ties were saved, while at Chattanooga, Tenn., tannery supplies to the value of $40,000 were moved to a place of safety, upon the advice of the forecast official.

The western tributaries of the Mississippi River, except the Missouri, fell steadily throughout the month. Those in the State of Louisiana, except the Atchafalaya, going below the danger lines for the first time in several weeks.

The condition of the rivers of New England and the Middle Atlantic States was very satisfactory, nothing of special interest was noted. There was a gradual fall throughout the month.

In the South Atlantic and east Gulf States the rivers were high during the early days of the month as a result of the heavy rains of the closing days of March. The necessary warnings had been issued and no harm was done, except that occasioned by the enforced delay in lumbering and lowland farming operations.

The highest and lowest water, mean stage, and monthly range at 175 river stations are given in Table VII. Hydrographs for typical points on seven principal rivers are shown on Chart V. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfield, Forecast Official.*

CLIMATE AND CROP SERVICE.

By Mr. JAMES BERRY, Chief of Climate and Crop Service Divison.

The following summaries relating to the general weather and crop conditions during April are furnished by the directors of the respective sections of the Climate and Crop Service of the Weather Bureau; they are based upon voluntary reports from meteorological observers and crop correspondents, of whom there are about 3000 and 14,000, respectively:

Alabama.—Quite cool, unfavorable for germination and growth. Temperatures as low as 30° in northern and north-central counties on 4th and 5th, slightly damaging frosts as late as 24th. Destructive local windstorms, hail, and excessive rains; generally deficient rainfall, favorable for work, except on lowlands, which crusted badly. Bulk of cotton and upland corn planted, but stands seriously injured by cold; minor crops did fairly well, fruit unpromising.—*F. P. Chaffee.*

Arkansas.—First decade was favorable for all farm work, and considerable progress was made in planting. During second decade cool, wet weather interfered with planting and prevented proper germination of seed. During third decade cool and dry, cotton planting was nearing completion, except in southern tier of counties, and early planted was coming up to a medium stand, poor color. Some corn was up, stand poor; considerable replanting of cotton and corn was necessary. Wheat and oats made slow progress. Considerable damage by frost on the 30th.—*Edward B. Richards.*

Arizona.—Cool weather prevailed during the greater portion of April, but there was some quite warm weather during the third decade. The greater part of the month was dry, and over a large area no rain whatever fell. There was considerable rain in the northern and central portions of the territory early in the month and about the middle of the month. The condition of crops was somewhat backward on account of cold weather, but the prospects at the end of the month were generally the best in years, due to rains earlier in the season and to the ample supply of irrigation water. This latter, however, was diminishing.—*M. E. Blystone.*

California.—The temperature was considerably below normal, and the rainfall less than average. Heavy frosts on the 10th and 11th caused slight injury to early deciduous fruits, but grapes and citrus fruits were not injured. The heavy rainfall in southern California caused very little damage to grain and new hay, and greatly benefited all crops. Grain and grass in the central and northern sections were beginning to suffer from scanty rainfall toward the close of the month.—*G. H. Willson.*

Colorado.—Temperature averaged nearly normal; the nights were so cool that germination and growth were slow; sharp frosts were frequent, culminating east of the mountains in a severe freeze at the close of the month, when gardens, early beets, alfalfa, and fruit suffered badly. Plowing and seeding made favorable progress and good stands of small grain were general. With the warm weather of the third decade, many varieties of fruit began to bloom in eastern and southern counties, and much damage resulted from the freezing weather that prevailed at its close. The snow remained unusually late in the mountains; considerable melting occurred on southern slopes and in unprotected places, but on the whole the amount of moisture stored in the form of snow or in the ground was greater than at the close of March. The ground was comparatively dry, and the run off had been small at the close of the month.—*F. H. Brandenburg.*

Florida.—The month was abnormally dry and cool. The general conditions were favorable for farm work, which was well advanced. The drought retarded germination, and low temperatures had an ill effect on cotton and corn. Cotton chopping was pushed and early corn worked several times; much replanting of both staples was necessary. Citrus trees suffered for want of rain, there being numerous reports of fruit dropping. Pineapples did very well. Oats suffered very much. The crop promises to be light.—*A. J. Mitchell.*

Georgia.—Frosts were quite general on the 5th, 23d, and 24th. The rainfall was slightly above normal in the middle section and deficient elsewhere. The weather was not favorable for crops. Cotton planting was very late and germination and growth were slow; cool weather during the latter portion of the month caused many young plants to die and stands were generally poor. Wheat and oats were attacked by rust and the hessian fly and deteriorated steadily. A short peach crop is anticipated. The season is very backward throughout the entire State.—*J. B. Marbury.*

Idaho.—Severe frost occurred on the 29th; most of the fruit was thought to be uninjured. Precipitation averaged nearly normal and was well distributed throughout the month, occurring at some stations on every day except the 13th. Vegetation backward, but otherwise in good condition.—*S. M. Blandford.*

Illinois.—During the first decade the temperature was above the seasonal average, the soil had dried out, and plowing was being actively prosecuted. Wheat was in a promising condition; considerable progress had been made in the seeding of oats and meadows and pastures were making vigorous growth. Conditions during the latter part of the month were generally unfavorable. Rains made the soil heavy and plowing was retarded; unseasonably cold weather arrested the growth of wheat and affected the germination of oats.—*William G. Burns.*

Indiana.—At beginning of April wheat, rye, clover, timothy, and pastures were showing growth in advance of season and some oats had been sown; but excessive moisture in ground and low temperature with frequent frosts during the month delayed farm work and retarded growth of vegetation, so that at its close oats had not all been sown, but little plowing for corn had been done, the grasses and fall sown cereals were in only average condition, and fruit had been greatly injured.—*W. T. Blythe.*

Iowa.—Conditions were favorable for an early start of grasses and winter grains; but at the outset the soil was saturated and was kept excessively moist by seasonal rains and the prevalence of cloudy and misty weather. This retarded seeding and plowing for corn to an unusual extent, and the usual acreage of oats and spring wheat was somewhat reduced by excessive moisture in fields intended for these crops.—*John R. Sage.*

Kansas.—Wheat in good condition, growing well, and the third week began jointing in several counties; but little damage from hessian fly. Oat sowing finished. Much corn planted. Frost cut off early apples and injured all fruit.—*T. B. Jennings.*

Kentucky.—The temperature averaged considerably above the normal during the first twelve days of April and all vegetation got an excellent start. The remainder of the month was cool. Light frost occurred in many localities on the 18th, 22d, and 23d, but no serious damage resulted. Cool nights retarded the growth of vegetation to quite an extent during the latter part of the month. Farm work was delayed by frequent rains, and at the close of the month was quite backward.—*H. B. Hersey.*

Louisiana.—The weather during the month was not favorable for agricultural interests. Preparations for cotton planting and planting were pushed vigorously during the early part of the month, but by the close of the second decade a general drought was interfering materially with farm work. The cotton crop is from two to three weeks late. As a

result of the drought and cold weather, and frost on the night of April 30, much replanting will be necessary. Sugar cane made satisfactory growth during the first decade, but dry, cool weather during the remainder of the month retarded its growth; through the conservation of moisture by tillage, however, the crop held its own. Rice seeding progressed. Truck gardens were backward.—*I. M. Cline.*

Maryland and Delaware.—The severe frosts of the 5th and 6th injured tender growth, and seriously reduced the prospective yields of all fruits, except apples. The long wet spell early in the month hurt wheat, especially in the lowlands. All farming operations were delayed until the final ten days, and the acreage of oats was considerably reduced. Very little ground was prepared for corn. Grasses grew fairly well. Tobacco plants were plentiful and healthy. All truck operations were quite backward.—*Oliver L. Fassig.*

Michigan.—There was too much precipitation during the early part of the month in the central and southern counties to permit of much fieldwork. The latter part of the month was drier and more favorable for fieldwork, but the cool, frosty weather during the last decade retarded growth and germination. At the close of the month plowing was general in all counties of the lower peninsula and had been begun in most counties of the upper. Oat, pea, and barley seeding were well advanced in the lower peninsula, and in the upper peninsula farmers were beginning to sow oats, peas, and spring wheat. Just as the month closed sugar beet seeding was quite generally begun in the principal sugar beet counties, and early potato planting was in progress in most of the central and southern counties.—*C. F. Schneider.*

Minnesota.—The soil was wet and frequently frozen until about the 12th; after that there were occasional rains, which, in the Red River Valley, were hardly heavy enough to delay seeding. On the 24th there was light snow in a few southeastern counties. Seeding in the Red River Valley was almost continuous after the 15th, and at the close of the month wheat seeding was everywhere well advanced. Oat and barley seeding was progressing well, and some potatoes and flax had been put in. Germination was slow late in the month because of cold weather.—*T. S. Outram.*

Mississippi.—Planting was about completed, except in the overflowed districts, but the cool and unprecedentedly dry weather was very unfavorable for germination and growth. Corn came up slowly and stands were generally poor; some replanting was done. Very little cotton came up. Oats deteriorated rapidly. Vegetable crops were backward, except potatoes, which did fairly well. Strawberries made a fair yield. The outlook for tree fruits was good south, but poor north.—*W. S. Belden.*

Missouri.—The weather was generally unfavorable for farming operations; the soil remained heavy and cold, delaying plowing and planting, and the low temperatures of the middle and latter parts of the month retarded the germination of seeds and the growth of vegetation. At the close of the month corn planting was well advanced in the southern sections, but in the central and northern counties but little planting had been done. The month closed with a killing frost, which was very destructive to fruit of all kinds.—*A. E. Hackett.*

Montana.—A cold, backward spring greatly retarded farm work. In the south-central counties, in sections of Meagher and Fergus counties, and in the valleys on the west side of the main range moist snows were frequent, but in other parts of the State more moisture is needed. Ranges have not made satisfactory progress. At end of month farm work was under way, but was being prosecuted with difficulty on account of dry, cold weather. The freezes and frosts damaged some early vegetables, but did not seriously affect winter wheat.—*Montrose W. Hayes.*

Nebraska.—Oats and spring wheat were sown under favorable conditions during the first two decades and generally came up well. Plowing and all farm work progressed well; but very little corn was planted because of the low temperature during the last of the month. Winter wheat continued in fine condition. The severe storm of the 28th and 29th, accompanied by temperatures ten or more degrees below freezing, was hard on all vegetation. Most of the early fruit was in bloom and was ruined, while late fruit was seriously damaged. Oats were injured somewhat, but probably will entirely recover. Wheat was not injured.—*G. A. Loveland.*

Nevada.—The month was slightly deficient in both temperature and precipitation. Weather favorable for plowing and seeding; the low night temperatures were unfavorable for the germination of seeds and the growth of vegetation. Early sown grain up and looking well at the close of the month. Fruit trees backward in blooming. Prospects for a water supply the best in many years.—*J. H. Smith.*

New England.—The weather of the month was pleasant and generally favorable for outdoor work and for farming operations; gardens were planted and much seeding done. It was, however, too cool, and in some sections too dry for vegetable growth. Fruit trees bloomed full, and excepting peaches, the conditions at the close of the month were favorable for a good crop. An increased acreage of tobacco was reported. Pasturage was good in many sections and stock was turned out.—*J. W. Smith.*

New Jersey.—The first half of the month was characterized by killing frosts on the 2d, 4th, 5th, and 6th, doing great injury to early orchard and small fruits then in bloom in the central and southern sections, and by frequent heavy rains, which retarded plowing and seeding; last half more favorable, during which time farm work advanced rapidly. The month closed with abnormally high temperature, 90° being recorded at many stations.—*Edward W. McGann.*

New Mexico.—A cold and backward month and vegetation very much retarded. Frost on morning of 30th killed over 50 per cent of the fruit in northeast portion of the Territory; in the central portion nearly all early fruits, such as peaches, apricots, cherries, and apples, were killed; in other parts prospects are very good. Grass on the ranges backward, and stock made slight improvement. Lambing season has been very satisfactory.—*R. M. Hardinge.*

New York.—While there were abnormally high and very low temperatures, and only light scattered showers after the 16th, the month of April as a whole was about normal as to temperature and precipitation. Owing to low temperatures and dry conditions wheat, rye, and grass declined, but fruit was considered to be safe up to the close of month, when seeding oats was in progress, some potatoes had been planted, and farmers were preparing corn land.—*R. G. Allen.*

North Carolina.—Conditions were decidedly unfavorable for growth of crops and for farm work during April. While the rainfall was only moderately above normal, it occurred in frequent showers, which kept the soil continuously unfit to be plowed, while the prevailing low temperatures prevented the proper germination of seeds. A severe freeze with killing frosts occurred throughout the State on the 5th, and other killing frosts in the west on the 18th and 24th, which seriously injured the fruit crop, though at a later date prospects for apples seemed favorable. Some planting was accomplished, chiefly corn on uplands; transplanting tobacco began, with plants fine and abundant. Winter wheat and oats deteriorated considerably. Truck crops and strawberries did fairly well.—*C. F. von Hermann.*

North Dakota.—The entire month was, as a rule, very favorable for farm work, except on lowlands, and in some few localities where there was too much rain. Wheat seeding became general about the middle of the month and progressed with but slight interruption until near the close, when killing frost and severe freezing weather caused either an entire suspension of or retarded work, especially on low, moist land. Vegetation was not sufficiently advanced to be damaged by the frosts.—*B. H. Bronson.*

Ohio.—Wheat improved, except in some poorly drained fields, and the general outlook for this crop was very promising. Plowing for corn delayed, and only a little done in the south. Oats did not germinate well, some reseeding was necessary. Pastures and grass advanced very slowly; the frosts of the last half of the month injured early clover, early cherries, plums, and strawberries in the south; apples and late fruit not damaged much.—*J. Warren Smith.*

Oklahoma and Indian Territories.—During the greater part of the month deficient and poorly distributed moisture made the surface soil almost impossible to work; the month was marked by short, but decidedly cool periods; that commencing with the 29th was accompanied by freezing temperatures and ice formation that cut early corn and cotton to the ground, and caused considerable damage to potatoes, grapes, berries, peaches, and pears, but potatoes and corn will probably revive; prospects were good for a fair crop of the larger fruit. Some corn was being cultivated. Cotton planting was in slow progress. Wheat suffered from lack of moisture, but recent rains brought it up to a good stand and the crop was making a good growth. Oats were in a poor condition. Alfalfa, rye, and grass made fair growth. Stock was in good condition.—*C. M. Strong.*

Oregon.—The month was somewhat cooler than usual. Precipitation was below the average, but sufficient fell to start grass and forage plants and render the soil in good condition for plowing and seeding. Vegetation in general made slow growth, owing to the cool nights. Frosts were frequent, and early fruits, especially peaches, were injured. The wheat crop, although backward, was thrifty and promising. Hops made excellent progress and work in the yards was actively pushed. Some corn and potatoes were planted. The wool clip and the increase in lambs were both below the average.—*Edward A. Beals.*

Pennsylvania.—The temperature and precipitation were practically normal, and the latter was exceptionally well distributed as regards area, but nearly all of it fell during the first half of the month. The month opened with conditions highly favorable to crops, which, as a whole, were from two to three weeks in advance of a normal season. The excess of moisture retarded farm work of all kinds and delayed seeding and planting during the first twenty days. The cool weather of the closing decade was unfavorable to germination and to the advancement of vegetation in general.—*T. F. Townsend.*

Porto Rico.—Cutting and grinding of cane favored by the weather. Grade of juice good, but cane did not yield normal amount. Young canes are doing well, but need rain. Tobacco harvest about completed, quality good, especially where raised under canvass. Coffee trees have blossomed abundantly and berries are developing rapidly. In some sections orange trees are being injured and killed by the June bug and white grub. Great interest has developed in the cultivation of Sea Island cotton. Stock has suffered for lack of water and pasturage.—*E. C. Thompson.*

South Carolina.—Few frosts occurred and none were damaging. The temperature averaged too low for favorable germination or for rapid growth. Drought along the coast was detrimental to truck crops, but over the greater portion the rainfall was ample. Grain aphis continued

In the following table are given, for the various sections of the Climate and Crop Service of the Weather Bureau, the average temperature and rainfall, the stations reporting the highest and lowest temperatures with dates of occurrence, the stations reporting greatest and least monthly precipitation, and other data, as indicated by the several headings:

Summary of Temperature and Precipitation by Sections, April, 1903.

Section.	Temperature—in degrees Fahrenheit. Section average.	Departure from the normal.	Monthly extremes. Station.	Highest.	Date.	Station.	Lowest.	Date.	Precipitation—in inches and hundredths. Section average.	Departure from the normal.	Greatest monthly. Station.	Amount.	Least monthly. Station.	Amount.
Alabama	61.0	−2.4	Dothan	89	29	4 stations	30	4, 5	2.72	−1.59	Oneonta	5.54	Daphne	T.
Arizona	60.7	−1.5	Aztec	103	23	Ashfork	14	13	0.22	−0.05	Flagstaff	3.85	15 stations	0.00
Arkansas	60.5	−1.3	Pine Bluff	91	9	Pond	26	26	1.82	−2.20	Corning	4.92	Fort Smith	0.36
California	54.8	−2.7	Salton	108	29	Bodie	−2	3, 11	1.28	−0.55	Cuyamaca	8.21	10 stations	0.00
Colorado	44.4	−0.8	Blaine	89	23	Ashcroft	−7	13	1.62	−0.23	Ruby	10.45	Holyoke	0.35
Florida	67.1	−1.8	Orange City Ocala	90 90	12 30	Quincy	34	14	0.45	−2.08	Pinemont	1.53	6 stations	0.00
Georgia	60.7	−2.6	Millen	92	11	Clayton	25	5	3.06	−0.31	Talbotton	6.80	Bainbridge	0.47
Idaho	42.5	−1.7	Blue Lakes	86	25	Lake	−4	12	1.31	−0.04	Grangeville	3.17	Cambridge	0.47
Illinois	52.8	+0.3	Aledo, New Burnside	88	9	Rantoul	16	4	4.32	+1.20	Robinson	8.01	Cairo	1.85
Indiana	51.8	−0.5	Madison, Salem	84	29	Laporte	10	5	4.42	+1.64	Edwardsville	7.36	Franklin	2.66
Iowa	49.8	+0.3	Mount Vernon	86	11	Larchmont	17	30	2.98	−0.03	Grand Meadow	6.00	Logan	0.74
Kansas	55.2	−0.3	Meade	99	9	Achilles	15	15	2.89	+0.23	Lakin	5.51	Viroqua	1.25
Kentucky	55.4	−0.5	Williamsburg	90	2	Williamsburg Pikeville	22 22	4 5	4.43	+0.55	Alpha	10.85	Paducah	2.14
Louisiana	65.7	−1.9	Minden	91	30	4 stations	32	4	1.11	−3.51	Robeline	2.45	Covington	0.17
Maryland and Delaware	52.4	+0.6	Boettcherville, Md.	95	29	Deer Park, Md., Sunnyside, Md.	13	5	4.02	+0.87	Bachmans Valley, Md	7.02	Delaware City, Del.	2.29
Michigan	42.7	−0.4	Carsonville	88	29	Humboldt	0	1	3.06	+1.24	Iron River	10.50	Cheboygan	0.10
Minnesota	43.3	−0.7	New Ulm	80	22	Tower	0	4	2.82	+0.36	Milaca	6.02	Crookston	0.98
Mississippi	63.4	−1.4	Natchez	92	9	Ripley	30	4	1.20	−3.03	Hernando	5.98	Poplarville	0.00
Missouri	55.8	+0.4	Protem	91	2	Vichy	26	4	3.54	−0.10	Monroe City	7.94	St. Joseph	1.32
Montana	41.0	−1.8	Glasgow	85	26	Adel	−9	29	1.45	+0.08	Dillon	5.36	Wibaux	T.
Nebraska	49.4	+0.1	Fort Robinson Bartley	89 89	1, 8, 27 27	Fort Robinson	9	29	1.80	−0.69	Wilber	4.17	Wallace	0.30
Nevada	45.2	−3.1	Rioville	101	24	Monitor Mill	1	1	0.47	−0.21	Austin	1.91	5 stations	0.00
New England	44.8	+1.5	3 stations	87	29, 30	Fort Fairfield, Me.	−1	5	2.69	−0.32	Kingston, R. I.	6.91	Chelsea, Vt.	0.80
New Jersey	50.9	+1.5	Beverly, Paterson	92	30	Charlotteburg, Layton.	18	6	3.97	+0.55	Hightstown	7.03	Cape May City	2.40
New Mexico	51.5	−1.8	Carlsbad	94	1	Luna, Winsors	10	3	0.43	−0.13	Winsors	1.88	5 stations	0.00
New York	44.5	+0.6	Gloversville	89	30	Saranac Lake	6	5	2.47	−0.03	Primrose	5.66	Carvers Falls	0.78
North Carolina	57.3	−0.4	Washington	91	30	Linville	15	5	4.81	+0.99	Bryson City	8.61	Hatteras	1.74
North Dakota	42.5	+1.3	Medora	83	25	Berlin	8	7	1.23	−0.56	Berlin	3.65	2 stations	T.
Ohio	49.9	0.0	Portsmouth	88	29	Hillhouse	10	5	4.01	+1.26	Strongsville	6.63	Green Hill	2.34
Oklahoma and Indian Territories	60.3	−1.3	Guthrie, Okla	98	1	Kenton, Okla	20	14	1.32	−1.54	Jenkins, Okla	3.52	Chickasha, Ind. T.	0.06
Oregon	46.7	−1.5	Grants Pass	84	24	Bend, Joseph	8	10, 11	2.22	−0.98	Nehalem	10.50	2 stations	0.00
Pennsylvania	48.8	+0.9	Philadelphia	90	30	Saegerstown	12	5	3.53	+0.34	Greensboro	4.93	Elwood Junction	2.16
Porto Rico	79.7	+0.1	Caguas	99	19	Barros	51	8	5.03	−1.00	La Isolina	13.75	Guayama	0.55
South Carolina	60.4	−1.7	3 stations	88	29, 30	Clemson College	26	4	2.95	−0.66	Liberty	5.55	Beaufort	0.85
South Dakota	46.9	0.0	Hotch City	87	26	Ramsey	9	30	1.69	−0.70	Spearfish	5.56	Highmore	0.70
Tennessee	57.1	−0.9	Waynesboro	89	12	Silver Lake	20	5	4.61	+0.13	Jonesboro	8.64	Covington	1.90
Texas	66.7	−1.8	Ira Fort Ringgold	97 97	2 2, 12, 19	Amarillo	26	30	1.03	−1.90	Houston	3.85	3 stations	0.00
Utah	46.0	−1.3	Blue Creek	95	23	Snowville Loa	4 4	11 12	1.01	−0.04	Kanab	2.79	Loa	0.00
Virginia	54.3	0.0	Lincoln	92	30	Hot Springs	12	4	4.26	+1.03	Bigstone Gap	7.43	Lynchburg	2.53
Washington	46.1	−2.2	Pomeroy Zindel	83 83	24 25	Wilbur	16	12	1.94	−0.68	Clearwater	9.30	Pasco	0.00
West Virginia	51.3	−0.3	Magnolia	91	30	Travellers Repose	8	5	4.47	+0.89	Logan	7.30	Upper Tract	2.29
Wisconsin	45.2	+0.3	Beloit	80	2	Hayward	8	3	3.15	+0.35	La Crosse	4.81	Hayward	1.49
Wyoming	39.9	−1.3	Basin	83	17	Embar	0	6	1.10	−0.52	Red Bank	4.02	Pine Bluff	0.47

to damage oats, and rust developed on wheat. Fruit prospects remained unimpaired. Tobacco was about all transplanted, and grew fairly well. Corn planting made rapid progress and cultivation was begun, but stands were injured by insects. Cotton planting progressed rapidly, but seed came up poorly, necessitating much replanting. The season, as a whole, was somewhat backward.—*J. W. Bauer.*

South Dakota.—Although interrupted somewhat by rain or snow, plowing and the seeding of spring wheat, oats, barley, and spelt progressed favorably, and the grain germinated evenly, though slowly, until the 27th. Grass started well, but grew slowly. On the 29th and 30th temperatures below freezing damaged growing grains, resulting in some permanent injury to some early oats and barley, but practically none to wheat. Some wheat and considerable oats and barley were yet to be sown at the close of the month.—*S. W. Green.*

Tennessee.—Farm work progressed well during the first twelve days of the month and vegetation advanced rapidly; the second half of the month was wet and cold, excepting a few days, and at its close seasonal work was behind hand and crops generally were backward. Frosts on the 23d and 24th injured Irish potatoes, tomatoes, and tender vegetation. Wheat showed the effect of unfavorable weather, and some had begun to head very low. Some tobacco was set out.—*H. C. Bate.*

Texas.—The month was unusually cool. Heavy frosts occurred in the northern portion on the morning of the 30th, and cotton on lowlands was generally killed, and corn cut to the ground. Drought generally prevailed, but this was broken in the southern portion by good showers on the 29th. By the 15th the ground had become too dry and hard to be properly worked, and cotton planting and germination were thereby delayed. Early planted cotton made poor stands, and much replanting was necessary. Corn planting was practically completed by the 15th, but poor stands were secured, and much had to be replanted. Cultivation of the early planted began during the middle decade. The growth of both cotton and corn was greatly retarded by the cool weather. Wheat, rye, and oats were considerably damaged by the drought.—*L. H. Murdoch.*

Utah.—Abnormally cold weather, with excessive cloudiness prevailed during April. The precipitation was slightly below the normal. Heavy frosts were frequent, and caused serious damage to apricots and sugar beets in localities. The seeding of wheat and oats was considerably delayed by cold weather. Early sown wheat was coming up well at the close of the month, but the late sown needed warmth for proper germination. Fall wheat was generally poor, and much alfalfa was found to be winter killed.—*L. Lodholz.*

Virginia.—The weather conditions throughout April were generally unfavorable for crop growth and for fieldwork, being rainy and with occasional cool spells and frosts. Small grain crops, which had entered the month in excellent condition, deteriorated considerably, becoming yellow and showing signs of rust in many localities. Seeding of spring oats and corn planting as well as preparation of corn land were much retarded. A severe freeze early in the month did great damage to early fruit bloom, especially to peaches and pears.—*Edward A. Evans.*

Washington.—Unseasonably cool, with frequent frosts until third decade, when there was a change to warm weather. Winter wheat and barley grew little before the 21st, after which warm rains followed by fine weather gave grain a considerable start. Fruit trees did not come into bloom until the last week. The lateness in blooming lessens the danger from frost, and is therefore favorable. The ground was too cold for planting until the last week. Wheat sowing was not finished at the end of the month. The season was fully three weeks later than usual.—*G. N. Salisbury.*

West Virginia.—Vegetation received a severe set back by the freeze of the 5th. Nearly all cherries, peaches, plums, and apples were killed. Even wheat, which was in the best condition in years, was slightly injured, and oats and clover were cut down in some cases. The weather continued unfavorable for growth during the rest of the month, and, at its close, but little improvement could be noted. Farm work was very backward, and plowing had been delayed by the wet condition of the ground. There was a prospect of some apples from late bloom.—*E. C. Vose.*

Wisconsin.—Although the average temperature for April was about normal, vegetation made but little progress, owing to the cloudy, wet weather and cold nights. Freezing temperatures were frequent throughout the month in the central and northern sections, and heavy frosts in the southern. The rains were frequent, copious, and well distributed, but not excessive. Seeding was much delayed by the wet weather, and was not entirely completed by the end of the month. Little progress was made in preparing for corn and potatoes. Winter wheat, rye, and grass made fairly good progress.—*W. M. Wilson.*

Wyoming.—Cool weather prevented range grass from getting a good start before the close of the month. Plowing and seeding made good progress over the earlier sections, but over some of the later sections practically no spring work was done before the close of the month. The storm from the 27th to 29th, which was accompanied by cold weather, was severe on weak cattle and newly shorn sheep, and some losses were reported.—*W. S. Palmer.*

SPECIAL CONTRIBUTIONS.

HAWAIIAN CLIMATOLOGICAL DATA.

By CURTIS J. LYONS, Territorial Meteorologist.

OBSERVATIONS AT HONOLULU.

The station is at 21° 18′ N., 157° 50′ W. It is the Hawaiian Weather Bureau station Punahou. (See fig. 2, No. 1, in the MONTHLY WEATHER REVIEW for July, 1902, page 365.)

Hawaiian standard time is $10^h\ 30^m$ slow of Greenwich time. Honolulu local mean time is $10^h\ 31^m$ slow of Greenwich.

The pressure is corrected for temperature and reduced to sea level, and the gravity correction, —0.06, has been applied.

The average direction and force of the wind and the average cloudiness for the whole day are given unless they have varied more than usual, in which case the extremes are given. The scale of wind force is 0 to 12, or Beaufort scale. Two directions of wind, or values of wind force, or amounts of cloudiness, connected by a dash, indicate change from one to the other.

The rainfall for twenty-four hours is measured at 9 a. m. local, or 7.31 p. m., Greenwich time, on the respective dates.

The rain gage, 8 inches in diameter, is 1 foot above ground. Thermometer, 9 feet above ground. Ground is 43 feet and the barometer 50 feet above sea level.

Meteorological Observations at Honolulu, April, 1903.

Date.	Pressure at sea level.	Temperature.		During twenty-four hours preceding 1 p. m. Greenwich time, or 1:30 a. m. Honolulu time.									Total rainfall at 9 a. m., local time.
				Temperature.		Means.		Wind.			Sea-level pressures.		
		Dry bulb.	Wet bulb.	Maximum.	Minimum.	Dew-point.	Relative humidity.	Prevailing direction.	Force.	Average cloudiness.	Maximum.	Minimum.	
	*	†	†			‡	‡		§				
1	30.05	67	60	72	61	57.3	71	ne.	3	7	30.17	30.04	0.08
2	30.05	66	62.5	74	64	56.7	66	ne.	4-2	4	30.11	30.02	0.22
3	29.99	62	61	76	62	61.0	74	ne.	3	4	30.08	29.99	0.01
4	29.95	70	65	79	61	62.3	77	se-ne.	3	4	30.04	29.94	0.01
5	29.98	70	67	78	67	62.5	71	ne.	4	3	30.03	29.95	0.42
6	30.02	72	67	76	66	67.0	84	ne.	1	10-8	30.06	29.95	0.43
7	30.01	71	66	77	69	63.5	72	ne.	2-4	9	30.08	30.01	0.01
8	30.01	70	66	77	70	63.0	70	ne.	3	10-4	30.08	29.99	0.03
9	29.98	68	64	76	68	61.3	71	ne.	4	4	30.07	29.96	0.05
10	29.99	67	62.5	74	66	61.5	75	ne.	4-1	4	30.06	29.97	0.16
11	29.99	68	61	72	63	57.7	69	ne.	3-6	8-2	30.04	29.95	0.01
12	30.00	68	63.5	75	67	57.0	64	ne.	5-3	3	30.06	29.96	0.01
13	50.01	70	66.5	77	66	61.3	71	ne.	4	3-6	30.06	29.97	0.22
14	30.03	71	66.5	73	67	64.7	82	ne.	5	8	30.11	30.01	0.20
15	30.09	70	63.5	76	68	63.0	74	ne.	5-6	7-10	30.14	30.02	0.10
16	30.09	68	62.5	74	68	61.0	72	ne.	5-4	8	30.15	30.06	0.02
17	30.04	69	63	75	68	57.0	64	ne.	4	1	30.11	30.03	0.01
18	30.04	71	66	77	67	59.7	67	ne.	3-4	5	30.08	29.99	0.05
19	29.97	68	63.5	77	68	63.0	74	ne.	4	7	30.08	29.97	0.03
20	29.94	71	64.5	77	66	60.7	70	ne.	3	6-2	30.02	29.93	0.10
21	29.94	67	66	78	67	60.7	66	ne.	3	5	29.98	29.90	0.01
22	29.95	69	65.5	79	66	63.3	76	ne.	3	4	30.01	29.92	0.01
23	29.94	70	65.5	79	69	62.7	72	ne.	3	5-1	30.01	29.92	0.00
24	29.92	70	65	78	68	63.0	72	ne.	3	2	30.00	29.88	0.00
25	29.92	68	66.8	80	69	63.5	71	ne.	3	1	29.96	29.90	0.00
26	29.94	71	68.5	81	67	67.7	80	se.	1-0	7-10	29.99	29.89	0.01
27	29.94	74	68.5	81	70	67.5	80	sw.	0-1	10-0	30.01	29.93	0.00
28	30.00	71	65.5	79	69	64.7	70	nne.	0-4	7-3	30.04	29.95	0.00
29	30.04	69	65	77	70	62.5	73	ne.	4-5	3	30.09	30.01	0.07
30	30.01	67	66	77	68	63.5	75	ne.	4-3	4	30.09	30.00	0.08
31	......	......	......	......	......	......	......	......	......	......	......	......	......
Sums	......	......	......	......	......	......	......	......	......	......	......	......	2.35
Means	29.994	69.1	64.8	77.0	67.0	62.3	72.8	......	3.2	5.1	30.090	29.967	......
Departure	—.027	......	......	......	......	......	......	......	......	0.0	......	......	—.55

Mean temperature for April, 1903, $(6+2+9) \div 3 = 71.9°$; normal is 72.6°. Mean pressure for April, 1903, $(9+3) \div 2 = 30.005$; normal is 30.032.

*This pressure is as recorded at 1 p. m., Greenwich time. †These temperatures are observed at 6 a. m., local, or 4.31 p. m., Greenwich time. ‡These values are the means of $(6+9+2+9) \div 4$. §Beaufort scale.

Maximum thermometer set at 9 p. m. and minimum at 2 p. m., local time.

GENERAL SUMMARY FOR APRIL, 1903.

Honolulu.—Temperature mean for the month, 71.9°; normal, 72.6°; average daily maximum, 77.0°; average daily minimum, 67.0°; mean daily range, 10.0°; greatest daily range, 18°; least daily range, 6°; highest temperature, 81°; lowest, 61°.

Barometer average, 30.005; normal, 30.032; highest, 30.15, on the 15th; lowest, 29.88, on the 23d; greatest 24-hour change, that is, from any given hour on one day to the same hour on the next, 0.06; lows passed this point on the 4th, 10th, and 23d; highs on the 1st, 15th, and 20th.

Relative humidity average, 72.8 per cent; normal, 71.5 per cent; mean dew-point, 62.3°; normal, 63.5°; mean absolute moisture, 6.22 grains per cubic foot; normal, 6.42 grains; dew, 3 mornings.

Rainfall, 2.35 inches; normal, 2.90; rain record days, 25; normal, 17; greatest rainfall in one day, 0.43, on the 6th; total at Luakaha, 17.73; normal, 11.06; at Kapiolani Park, 1.14; normal, 1.19.

Rainfall data for April, 1903.

Stations.	Elevation.	Amount.
HAWAII.		
HILO, e. and ne.	*Feet.*	*Inches.*
Waiakea	50	17.69
Hilo (town)	100	23.17
Kaumana	1,250	25.21
Pepeekeo	100	11.86
Hakalau	200	18.45
Honohina	300	23.15
Puuohua	1,050	48.85
Laupahoehoe	500	38.48
Ookala	400	23.57
HAMAKUA, ne.		
Kukaiau	250	21.72
Paauilo	300	13.32
Paauhau	300	8.87
Honokaa (Mill)	425	10.20
Honokaa (Meinicke)	1,100	......
Kukuihaele	700	13.18
KOHALA, n.		
Awini Ranch	......	19.68
Niulii	200	8.80
Kohala (Mission)	521	8.62
Kohala (Sugar Co.)	270	8.43
Hawi, Mill	700	......
Puakea Ranch	600	6.38
Puuhue Ranch	1,847	2.97
Waimea	2,720	3.49
KONA, w.		
Holualoa	1,350	5.88
Kealakekua	1,580	5.82
Napoopoo	25	2.87
Hoopuloa	1,650	......
Hoopuloa	2,500	......
KAU, se.		
Kahuku Ranch	1,680	......
Honuapo	15	2.04
Naalehu	650	3.13
Hilea	310	2.50
Pahala	850	3.00
Moaula	1,700	2.90
Volcano House	4,000	9.15
PUNA, e.		
Olaa, Mountain View (Russel)	1,690	28.72
Olaa (Plantation)	......	......
Kapoho	110	10.16
Pahoa	600	......
MAUI.		
Lahaina	40	......
Waiopae Ranch	700	1.89
Kaupo (Mokulau), s	285	7.96
Kipahulu, s	308	8.09
Hana	......	......
Nahiku, ne	800	42.29
Nahiku	1,600	......
Haiku, n	700	9.62
Kula (Erehwon), n	4,500	0.33
Kula (Waiakoa), n	2,700	0.68
Puuomalei, n	1,400	8.77
Paia	180	4.06
Haleakala Ranch	2,000	3.64
Wailuku, ne	250	3.12

Stations.	Elevation.	Amount.
OAHU.	*Feet.*	*Inches.*
Punahou (W. B.), sw	47	2.35
Kulaokahua (Castle), sw	50	1.69
Makiki Reservoir	120	2.80
U. S. Naval Station, sw	6	1.52
Kapiolani Park, sw	10	1.14
College Hills	175	3.17
Manoa (Woodlawn Dairy), c	285	8.96
Manoa (Rhodes Gardens)	360	12.87
School street (Bishop), sw	......	......
Insane Asylum, sw	30	2.98
Kamehameha School	75	......
Kalihi-Uka, sw	485	12.73
Nuuanu (W. W. Hall), sw	50	3.44
Nuuanu (Wyllie street)	250	6.07
Nuuanu (Elec. Station), sw	405	6.73
Nuuanu (Luakaha), c	850	17.73
U. S. Experiment Station	350	4.02
Pacific Heights	700	6.08
Laniakea (Nahuina)	1,150	10.67
Tantalus Heights	1,360	9.95
Waimanalo, ne	300	3.17
Maunawili, ne	300	8.26
Kaneohe	100	7.66
Ahuimanu, ne	350	10.28
Kahuku, n	25	1.92
Waialua	37	......
Wahiawa	900	4.08
Ewa Plantation, s	60	1.12
U. S. Magnetic Station	45	0.95
Waipahu	200	1.00
Moanalua	15	3.24
KAUAI.		
Lihue (Grove Farm), e	200	5.23
Lihue (Molokoa), e	300	5.30
Lihue (Kukaua), e	1,000	11.70
Kealia, e	15	3.01
Kilauea, ne	325	6.47
Hanalei, n	10	16.38
Waioli	10	17.75
Haena	15	16.30
Waiawa	32	......
Eleele	150	2.58
Wahiawa (Mountain)	3,000	29.30
McBryde (Residence)	850	9.21
Lawai (Gov. Road)	450	12.24
Lawai, w	225	4.46
Lawai, e	800	12.33
Koloa	100	4.21
Delayed March reports.		
Hakalau	......	10.51
Honohina	......	10.21
Kipahulu	......	4.95
Pahala	......	9.38
Moaula	......	10.61
Hoopuloa	2,500	4.15
Puuomalei	......	......
Wyllie Street	......	......

NOTE.—The letters n, s, e, w, and c show the exposure of the station relative to the winds.

The artesian well water level fell during the month from 34.85 to 34.75 feet above mean sea level. April 30, 1902, it stood at 34.10. The average daily mean sea level for the month was 9.65 feet, the assumed annual mean being 10.00 feet above datum. For April, 1902, it was 9.75.

Trade wind days, 27, (1 NNE.); normal, 20; average force of wind during daylight, Beaufort scale, 3.2. Average cloudiness, tenths of sky, 5.1; normal, 5.1.

Approximate percentages of district rainfall as compared with normal: Hilo, 185; Hamakua, 185; Kohala, 185; Waimea, 112; Kona, 145; South Kau, 80; North Kau, 140; Puna, 155; Maui, 150, except Kula, only 16; Oahu, town, 80; Koolau, 175; elsewhere on the island, 130; Kauai, 150, except Hanalei, 240. The heaviest 24-hour rainfalls for the month were at Nahiku (800), 7.08, 29th; Puuohua, 5.39 and Kapoha, 5.30 on the 15th. Heaviest monthly rainfall Puuohua, 48.85.

Mean temperature table.

Stations.	Elevation.	Mean max.	Mean min.	Cor. av'ge.
	Feet.	°	°	°
Pepeekeo	100	74.1	66.4	70.3
Waimea	2,730	66.9	56.3	61.0
Kohala	521	74.6	64.1	68.7
Waiakoa	2,700	78.7	55.7	66.5
United States Magnetic Station	50	81.5	65.6	73.0
United States Experimental Station	350	78.1	66.2	71.5
W. R. Castle	60	....	....	71.3
Hilo	40	81.0	65.9	72.8

Kohala dew-point average, 68.7°; relative humidity, 84 per cent; Magnetic Station, 62.2° and 69 per cent; Ewa Mill, 60.5° and 58 per cent.

Heavy surf, 5th, 11–15th, 18th; lightning seen at Pepeekeo, 25th and 26th. light snow on Mauna Kea, 11th; slight earthquake at Hilo, 2 a. m., 19th.

An unusually large meteor passed over East Hawaii from the south at 5:30 a. m. on the 30th, seen at Hilo, North Hilo, Hamakua, and said to have been visible over Haleakala on Maui; though there may have been two distinct meteors. The noise of its passage was mistaken for thunder by the Pepeekeo observer and others. A fragment weighing over a ton is reported as having been found by a native in Kau, but no subsequent report has yet confirmed this.

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined titles have been selected from the contents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau. Unsigned articles are indicated by a ——.

Science. New York. N. S. Vol. 17.

Ward, R. DeC. Helm Cloud in the Blue Ridge of North Carolina. [Note on article of W. M. Davis.] P. 712.

Ward, R. DeC. Meteorological Phenomena of Volcanic Eruptions. [Note on article of R. B. White.] Pp. 712–713.

Ward, R. DeC. General Circulation of the Atmosphere. [Note on report of Dr. Hildebrandsson.] Pp. 752–753.

Scientific American. New York. Vol. 88.

—— Origin of the Word "Barometer." [Note on article of Henry Carrington Bolton.] P. 395.

Scientific American Supplement. New York. Vol. 55.

—— Some properties of the Radiation of Radio-active Bodies. Pp. 22862–22863.

—— The Conundrums of Radium. Pp. 22863–22864.

Lodge, Oliver. On electrons. Pp. 22898–22899.

Hammer, William J. Radium and Other Radio-active Substances. Pp. 22904–22907.

Nature. London. Vol. 67.

Mellor, J. W. The Thermal Energy of Radium Salts. P. 560.

Lockyer, William J. S. Solar prominence and Spot Circulation, 1872–1901. Pp. 569–571.

Harris, R. A. A New Theory of the Tides of Terrestrial Oceans. Pp. 583–584.

Bonney, T. G. March Dust from the Soufrière. P. 584.

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Strutt, R. J. Energy Emitted by Radio-active Bodies. P. 6.

Lockyer, William J. S. The Solar and Meteorological Cycle of thirty-five years. Pp. 8–10.

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Burrows, Alvin T. The Chinook Winds. Pp. 124–125.

Symons's Meteorological Magazine. London. Vol. 38.

Joly, C. J. Irish Barograms of the Storm of February 26. Pp. 49–50.

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Brown, Robert Marshall. Climatic Factors in Railroad Construction and Operation. Pp. 178–190.

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Townsend, John S. The Conductivity produced in Gases by the Aid of Ultra-Violet Light. Pp. 389–398.

McLennen, J. C. Induced Radioactivity Excited in Air at the Foot of Waterfalls. Pp. 419–428.

Wilson, Harold A. A Determination of the Charge on the Ions produced in Air by Röntgen Rays. Pp. 429–441.

Rutherford, E. The Radioactivity of Uranium. Pp. 441–445.

Rutherford, E. A comparative Study of the Radioactivity of Radium and Thorium. Pp. 445–457.

Parks, G. J. On the Thickness of the Liquid Film formed by Condensation at the Surface of a Solid. Pp. 517–524.

Trowbridge, John. On the Gaseous Constitution of the H and K lines of the Solar Spectrum, together with a Discussion of reversed Gaseous Lines. Pp. 524–529.

Durack, J. J. E. On the Specific Ionization produced by the Corpuscles given out by Radium. Pp. 550–561.

Rutherford, E. and **Soddy, F.** Condensation of the Radio-active Emanations. Pp. 561–576.

Rutherford, E. and **Soddy, F.** Radioactive Change. Pp. 576–591.

Ciel et Terre. Bruxelles. 24me année.

Prinz, W. Analyse complémentaire de la boue tombée en Belgique le 22 février 1903. Pp. 75–81.

Hildebrandsson, H. H. Sur la circulation générale de l'atmosphère. Pp. 82–90.

Hildebrandsson, H. H. Sur la circulation générale de l'atmosphère. Pp. 105–118.

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Le Cadet, G. Étude de l'électricité atmosphérique au sommet du mont Blanc (4810*m.*) par beau temps. Pp. 886–888.

Nordmann, Charles. Sur les propriétés magnétiques de l'atmosphère terrestre. Pp. 960–962.

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Angot, Alfred. Sur le calcul des moyennes et la variabilité de la température en France. Pp. 53–59.

Thévenet, —. Recherches de thermodynamique sur la distribution des éléments météorologiques à l'intérieur des masses d'air en mouvement. Pp. 59–61.

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Langevin, P. Recombinaison et mobilités des ions dans les gaz. Pp. 433–530.

Archives des Sciences Physiques et Naturelles. Genève. 4me période. Tome 15.

Gautier, R. Observations météorologiques faites aux fortifications de Saint-Maurice pendant les mois de août, septembre, octobre et novembre 1902. Pp. 327–334.

La Nature. Paris. 31me Année.

Gall, J. F. Station météorologique de la Schlucht. Pp. 275–276.

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Oppolzer, Egon R. v. Erdbewegung und Aether. Pp. 244–254.

Stankewitsch, B. W. Magnetische Messungen, ausgeführt im Pamir im Sommer 1900. Pp. 276–295.

Lampa, Anton. Der Gefrierpunkt von Wasser und einigen wässerigen Lösungen unter Druck. Pp. 316–332.

Benndorf, Hans. Beiträge zur Kenntnis der atmosphärischen Elektricität. X. Ueber ein mechanisch registrierendes Elektrometer für luftelektrische Messungen. Pp. 487–512.

Das Wetter. Berlin. 20 Jahrgang.

Treitschke, Friedrich. Die Witterung in Thüringen im Jahre 1902. Pp. 73-82.

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—— Die Sonnenflecke in ihrer Veränderlichkeit von 1749 bis 1901. Pp. 351-357.

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Seidel, H. Klima und Wetter auf den Marianen. Pp. 139-144.

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Wassmuth, A. Apparate zum Bestimmen der Temperaturänderungen. P. 146-161.

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Hergesell, —. Ueber Aufsteigen von geschlossenen Gummiballons. Pp. 163-168.

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Woeikof, A. Das Warmwasser vor den Strassen von Gibralter und Bab-el-Mandeb. P. 220.

Mittheilungen von Forschungsreisenden und Gelehrten aus den Deutschen Schutzgebieten. Berlin. Band 16.

—— Resultate der meteorologischen Beobachtungen in Deutsch-Südwestafrika für das Jahr Juli 1901 bis Juni 1902. [Abstract of article by Thomas.] Pp. 9-20.

Maurer, Hans. Zusammenstellungen von Monats-und Jahresmitteln von 34 Beobachtungsstationen. Pp. 20-108.

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—— Ein neuer Winddruckmesser. Pp. 70-71.

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Draenert, F. M. Zum Klima des Staates Ceará, Brasilien. Pp. 156-162.

Grundmann, G. Ueber die Ausmessung meteorologischer Photogramme. Pp. 162-168.

—— James Glaisher. P. 170.

—— Raimund Prugger. P. 170.

Hergesell, —. Vorläufiger Bericht über die internationale ballonfahrt vom 9. Januar 1903. Pp. 171-172.

Hergesell, —. Vorläufiger Bericht über die internationale Ballonfahrt am 5. Februar 1903. Pp. 172-173.

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—— Stauberfüllte Atmosphäre über dem Ozean in W. der afrikanischen Küste. Pp. 175-176.

—— Die Beobachtungen auf der Zugspitze im Jahre 1902. P. 176.

Maurer, H. Zur Frage der "gestrengen Herren" oder "Eismänner." Pp. 176-178.

Wolfer, A. Provisorische Sonnenflecken-Relativzahlen. P. 178.

H[ann], J[ulius]. Zum Klima von Dahomey. P. 178.

—— Der Sturm von 26-27 Februar 1903 in England. Pp. 178-180.

—— Sturm in Frankreich am 2. und 3. März. P. 180.

Hann, J. Ergebnisse 43 jähriger Regenmessungen auf der Insel Malta. Pp. 180-181.

—— Luftdruckveränderungen infolge von Vulkanausbrüchen. Pp. 181-182.

Schwalbe, G. Eduard Hoppe: Regenergiebigkeit unter Fichtenjungwuchs. Pp. 182-183.

—— Merkwürdige meteorologische Phänomene in Australien. P. 183.

—— Staubströme in Australien. P. 183.

Margules, M. Ueber rasche Erwärmungen. Pp. 183-187.

—— Meteorologische Beobachtungen zu Paramaribo. P. 187.

Friesenhof, ——. Leuchtende Wolken. Pp. 187-188.

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—— Dürre in Südaustralien. P. 189.

—— Gewitter bei heiterem Himmel. P. 189.

THE WATER EQUIVALENT OF SNOW ON GROUND.

By CHARLES A. MIXER, Civil Engineer, Rumford Falls, Me.

In a letter of March 7, 1903, to Dr. H. C. Frankenfield, in charge of the River and Flood Service, Mr. Charles A. Mixer, resident engineer of the Rumford Falls Power Company, at Rumford Falls, Me., on the Androscoggin River, communicates the following interesting observations:

"My usual gaging of the snow on the ground consists in

simply getting a correct and full sample of the snow on the ground and then melting it to get the water equivalent. The sample is secured by forcing a cylinder down to the ground, then shoveling down around it and inserting a sheet metal bottom and lifting it out. On my voluntary observer's report for March, 1900, there is given my first report of such measurements. On account of the unusual depth of snow on the ground at a late date and its peculiar condition, I was led to make some measurements that season: these were on March 17, depth of snow, 38 inches; water equivalent, 10.49 inches; on the 31st the snow had settled to 20 inches, and the water equivalent was 9.84 inches. This represents ordinarily about 100 inches of winter snowfall, and is practically the whole winter's precipitation, to be added, when it runs off, to the greater spring precipitation. Think of this depth of water covering the surface waiting to be released, and imagine what would happen if all of it should run at once into the little river channels! This must have an important bearing on flood warnings. By gaging the snow, one can know in advance what may be expected, modified of course by considerations as to whether the snow melts and evaporates in the sunshine only or melts with the added help of a warm rain. I have kept up the measurements since my first observation in 1900, especially at the end of winter when the snow begins to go off.

"Another thought that led me first to such observations was my need of a sufficient explanation for certain monthly records of run off amounting to from 200 per cent to 500 per cent of the monthly precipitation. Of course this applies only to northern rivers, but the higher the altitude and latitude the more it means. At my present station, this season, the snow on the ground in an open place where my gage stands, measured on the 28th of February, 1903, only 19 inches, and gave 6.29 inches of water, but above us in the woods the snow is reported to be 4 to 6 feet deep. In connection with some of the northern rivers, this water that is held back, being stored in congealed form and waiting to go down, should be taken into consideration in order to get some advanced information."

RIVER FLOODS AND MELTING SNOW.

By CHARLES A. MIXER, Civil Engineer, Rumford Falls, Me., dated April 25, 1903.

The minimum discharge of the Androscoggin River occurs in February, and during the winter season the run off is controlled almost entirely by the temperature. The annual average run off is about 55 per cent of the annual precipitation, and varies monthly between 200 and 400 per cent of the total monthly precipitation. While trying to explain to myself the large run off in the springtime of from 2 to 4 times the monthly precipitation, I was led to consider the heavy covering of snow and noted it as an accumulated precipitation held in cold storage, to be released by warm weather; sometimes its release is accelerated, and its volume is increased by warm rains. In March, 1900, the depth of snow on the ground was more than the average, and being very heavy I thought to determine its water equivalent. I obtained a sample by pressing a cylinder down to the ground, digging around the outside, inserting a bottom of sheet metal and lifting out the sample. The result was entered on my monthly report as a voluntary observer, viz, March 17, snow on the ground, 38 inches; water equivalent, 10.49 inches. By the 31st the sun had settled the snow nearly one-half, and it was much heavier; the measurement gave 20 inches of snow and the equivalent water, 9.84 inches. I have made more such gagings since then, but not regularly. I have not usually made them systematically, but only at what seemed to be the end of the winter season. I have described the method to a number of others, but have never found one who had heard of it or tried it. Of course, in some parts of the country, men have no opportunity to see a large accumulation of snow or the remainder of three

or four months of snowfall. This year I measured it on February 28, 1903, and happening that day to write Prof. U. C. Grover, at Orono, Me., on hydrographic matters, I described the process and results to him. About March 16 Professor Grover made a gaging of 22 inches of snow, giving 8 inches of water. My gaging on February 28 was 19 inches of snow, giving 6.12 inches of water. Hereafter, I will make the observations frequently and regularly, and will also make them in the woods where the snow is usually twice as deep in the springtime as it is in the open space where my snow gages are. I am persuaded that such observations of the snow depths and equivalent water will be valuable everywhere, as additional information relative to the run off that may be expected, but the height of the freshet that it may produce will depend on the rate at which the snow melts. Here, at Rumford Falls, it is very interesting to see the Androscoggin rise and fall with the temperature, and to see the high discharge maintained for days in succession by the melted snow that comes first from near by and subsequently from greater distances and higher altitudes. Some simultaneous precipitation, temperature, and run off records are plotted in the accompanying diagrams, using my weather reports in connection with the daily discharge of the river, as furnished to Mr. F. H. Newell, of the United States Geological Survey, and printed in Water Supply Paper, No. 69, and subsequent numbers.

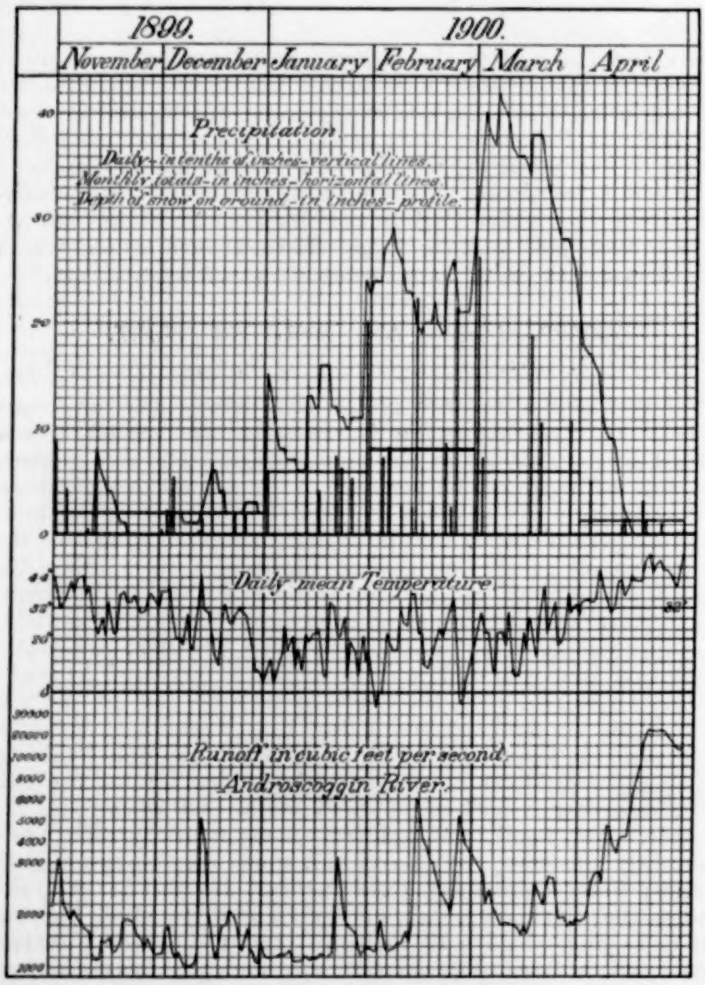


Fig. 1.—River and weather observations at Rumford Falls, Me.

These diagrams (figs. 1, 2, 3, 4) show the run off, temperature, precipitation, and the snow on the ground at Rumford Falls, Me., on the Androscoggin River, during the last four winters. It is desirable to plat more years and all of the last year, but these diagrams have been made primarily in connection with our recent correspondence concerning snow on the ground, its water equivalent, and its disappearance. The diagrams begin with the winter of 1899–1900 in order to show the heavy snowfall when I first took the water equivalent of the snow on the ground; it was a season of more than the average precipitation, mostly in snow form, and a deep accumulation of snow. The winter of 1901–2 is included as it is an example of the opposite conditions in this locality; precipitation was small, much of it as rain, and no accumulation of snow.

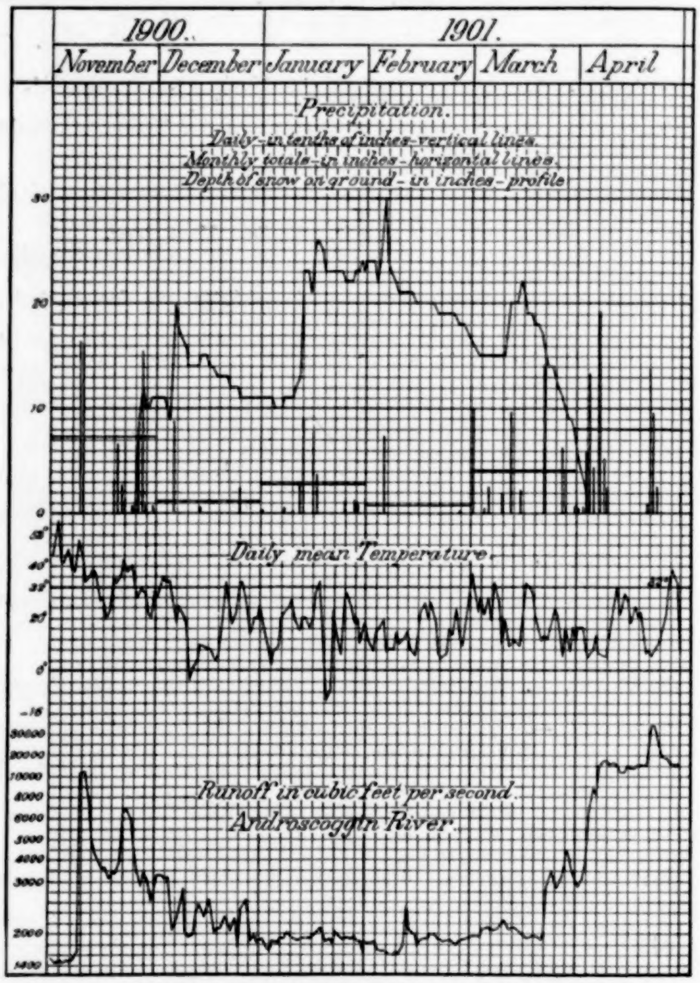


Fig. 2.—River and weather observations at Rumford Falls, Me.

It will be noticed that the vertical scale of the diagrams of run off changes, viz, the first inch is 1000 cubic feet per second; the second inch is 2000; the third inch is 7000, and the fourth inch is 50,000. Note also that this river has an extensive and well managed system of storage at an elevation of about 1000 feet higher than this station, so that the run off is regulated as much as possible. The effect of this regulation is greatest at low water and least during the freshets. Remember also that the run off measured here does not come from the precipitation received here, but from precipitation in a basin north of us with altitudes 500 to 3000 feet higher. There may not generally be much difference between the precipitation here and the average of that drainage basin. The principal effect of snow accumulation in the present studies is that the melting of the snow is delayed on the higher altitudes, and the spring freshet is prolonged beyond the complete disappearance of snow around here.

In each of the four winters it will be noticed that precipitation during a mean temperature above 32° F., therefore rain rather than snow, raises the river, but precipitation during temperatures below 32°, therefore in snow, does not affect the river. A sudden and considerable fall in temperature,

whether in connection with precipitation or not, causes an equally sudden fall of the river as on April 1, 1901; January 1, 1902; March 6, 1902; December, 1902, and February, March, and April, 1903. This is more marked if the ground be bare or has only a light covering of snow. Observe that in April, 1900, the total precipitation for the month was only 1.21 inches, but the run off of the river was maintained at more than 20,000 cubic feet per second for a week by snow melting during warm weather. Notice the close parallelism of the run off and temperature profiles during this month of April, 1900, and then compare this month with April, 1901, when the precipitation was excessive, amounting to 7.91 inches. The snow on the ground on the higher portion of the drainage basin was only ordinary, yet in combination with the warm rains the river discharge for about twenty-four hours during the parts of two days in April, 1901, reached 35,000 cubic feet per second. If the rains of 1901 had come in combination with a snow accumulation like 1900, as it sometimes does, the river discharge might have again equaled 55,000 cubic feet per second as it did in April, 1895.

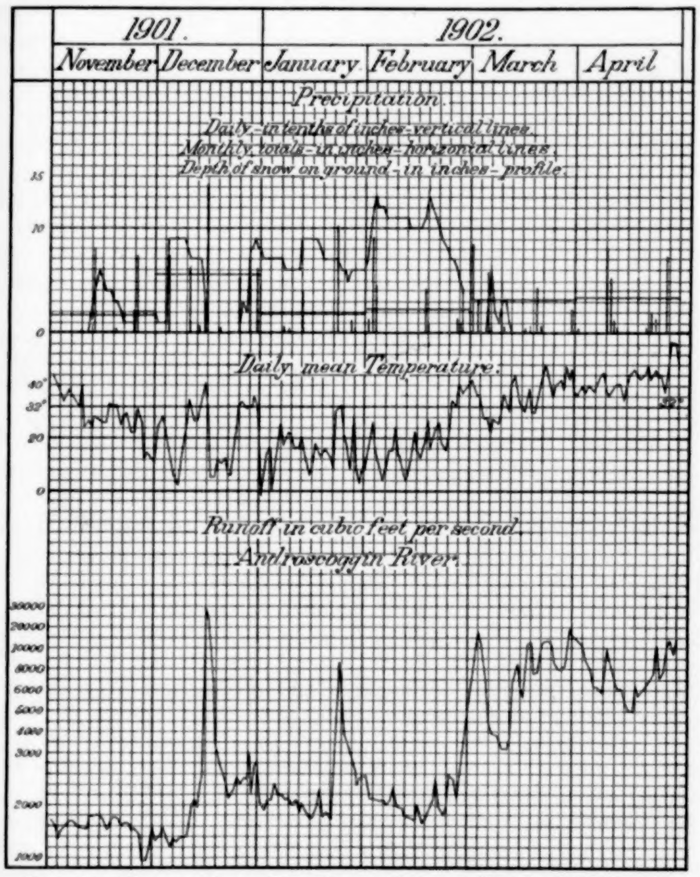


FIG. 3.—River and weather observations at Rumford Falls, Me.

All the conditions of the winter of 1901-2 were unusual. The entire season was broken and disturbed. Note the irregular monthly precipitation, coming generally with temperatures higher than 32°. The ground was bare twice; high water occurred in December, 1901, January, and March, 1902, each time carrying out the ice. The river discharge about the middle of December (made up of an ordinary amount of snow on the ground and a warm rain) was nearly 28,000 cubic feet per second, which was without precedent for the month of December. The usual spring freshet in March or April did not occur in 1902, because there was no snow on the ground and no hard rains fell. The winter just passed (1902-3) was approximately normal, excepting that it ended early, and the snow was carrried off earlier than usual by the unprecedented high temperature of March last. There were no heavy rains, and an ordinary spring run off was maintained as controlled naturally by the temperature and the snow on the ground. Notice again the parallelism of the temperature and the run off profiles during March and April, 1903.

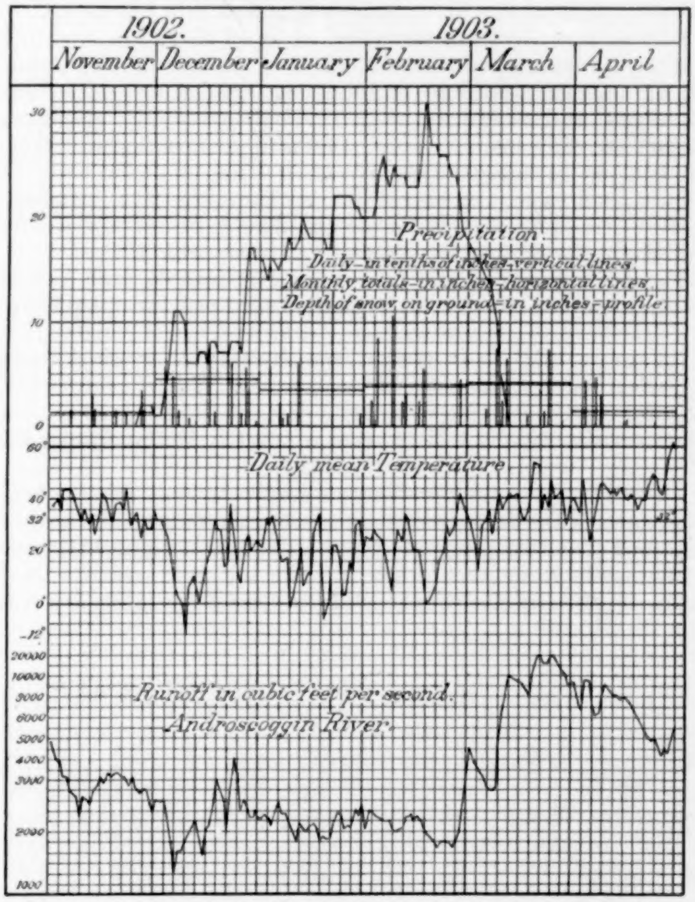


FIG. 4.—River and weather observations at Rumford Falls, Me.

Of course the limited observations and records of these four winters are not sufficient to establish any rules, but much can be learned from them. Other interesting and instructive conditions, combinations, and results may be found in these diagrams. I do not believe that another recent period as short as this could have been selected that would show so many different and extreme conditions.

TYPICAL OCTOBER WINDS ON OUR ATLANTIC COAST.

By T. H. DAVIS, dated April 13, 1903.

In Scribner's Magazine for June, 1902, there is an article by Harvey M. Watts on "The Gulf Stream myth and the anticyclone." While very much of his writing is logical and scientific he appears to me when dealing with the north Atlantic cyclone to be just as strongly imperative as was M. F. Maury with his cherished Gulf Stream. My attention has been particularly drawn to Mr. Watts' Chart No. IV, and I have made a comparison between his supposed wind directions at Boston, New York, New Haven, and Philadelphia, and the actual observations for the past eleven years at those stations. The result is that this chart does not present the winds prevailing on a typical October day.

Moreover, his explanation of so-called Indian summer, warm waves, and mild spells, does not seem to be in accordance with what are considered the fundamental principles of meteorology. Granting that the permanency of the north Atlantic cyclone is absolutely established, and that its annual north and south tropical migrations are scientific truths, how can it be shown that the anticyclonic effects can be manifested along its west-

ern margin more at one season than another? It does not seem to me in accordance with our knowledge of meteorology. In my researches into wind frequency I have not discovered any proof that there are any such lateral movements of the Atlantic anticyclone, as stated by Mr. Watts in his paper.

I think that closer observation of wind direction, viz, to 16 points of the compass instead of 8, or in fact to the nearest 10° of azimuth would be of immense value in absolute determinations, and would prevent the indiscriminate placing of arrows showing such directions of wind as bear out individual conceptions of accepted theories.

I am, and expect always to be, a champion of the theorem that the relative frequency of the directions of the wind is one of the fundamental principles of meteorology.

The accompanying five tables for stations on our Atlantic coast show that the most frequent directions for October are as follows:

Boston, west; New Haven, southwest; New York, west; Philadelphia, northwest. Whereas Mr. Watts' charts give: Boston, southeast; New Haven, east of south, or possibly south-southeast; New York, east of south; Philadelphia, west of south; Washington, south-southwest.

The dignity of meteorology as a science can only be maintained by adhering closely to observed natural phenomena. We shall make no progress by popular discussions of suppositious events.

TABLE 1.—*Observed frequency of wind directions for the month of October.*

Year.	Boston.									Year.	New York.								
	N	NE	E	SE	S	SW	W	NW	C		N	NE	E	SE	S	SW	W	NW	C
1891..	4	4	3	1	1	6	6	6	0	1891..	2	5	1	2	3	6	2	10	0
1892..	2	1	1	1	1	6	11	8	0	1892..	1	1	1	2	2	11	3	10	0
1893..	1	3	4	2	3	7	5	6	0	1893..	2	4	2	4	5	5	1	8	0
1894.	2	6	4	1	2	6	8	2	0	1894..	4	6	1	1	5	5	5	4	0
1895..	3	2	1	1	2	6	7	9	0	1895..	3	3	2	1	4	6	4	8	0
1896..	6	5	1	1	3	4	7	4	0	1896..	5	5	1	1	4	4	3	8	0
1897..	5	5	2	1	2	6	4	6	0	1897..	3	9	2	1	3	6	2	5	0
1898..	4	2	5	1	4	5	5	5	0	1898..	2	5	4	5	3	3	2	7	0
1899..	4	3	4	1	2	6	5	6	0	1899..	2	5	3	3	3	4	4	7	0
1900..	4	8	1	1	2	6	4	5	0	1900..	3	4	6	2	3	5	2	6	0
1901..	2	0	2	2	3	9	6	7	0	1901..	2	2	1	3	3	8	3	9	0
	Philadelphia.										Washington.								
1891..	2	6	2	2	0	6	2	11	0	1891..	4	5	2	1	5	2	2	9	1
1892..	1	3	0	1	2	8	4	12	0	1892..	3	2	1	1	5	3	4	11	1
1893..	5	4	4	3	2	4	3	6	0	1893..	5	7	1	2	5	3	2	5	1
1894..	2	5	4	1	3	5	5	5	0	1894..	5	3	2	2	5	2	3	7	2
1895..	5	4	1	0	3	5	4	9	0	1895..	5	3	0	2	6	2	3	10	0
1896..	8	4	1	1	2	4	4	7	0	1896..	6	4	1	2	6	1	2	8	1
1897..	4	10	2	2	2	6	2	3	0	1897..	7	9	1	1	7	2	1	2	1
1898..	3	4	3	5	4	3	2	7	0	1898..	3	4	4	3	5	1	3	7	1
1899..	5	6	2	2	1	9	2	4	0	1899..	5	5	4	2	6	1	1	4	3
1900..	5	6	4	2	2	5	3	4	0	1900..	3	6	3	3	5	1	2	6	2
1901..	4	2	2	3	3	6	5	6	0	1901..	2	3	2	5	5	2	2	8	2
	New Haven.										New Haven.								
1873..	6	3	1	2	3	5	3	4	4	1887..	6	4	1	1	4	4	6	4	1
1874..	5	3	1	1	3	6	5	6	1	1888..	4	3	0	1	2	3	5	11	2
1875..	8	4	1	1	1	7	5	3	1	1889..	3	10	1	1	3	3	4	6	0
1876..	3	2	0	1	1	8	5	8	3	1890..	4	9	1	1	1	2	4	6	3
1877..	7	4	2	1	1	7	1	6	2	1891..	8	6	0	2	1	6	3	4	1
1878..	6	3	1	1	6	6	4	4	0	1892..	3	2	1	0	3	5	8	8	1
1879..	2	3	1	3	2	8	4	7	1	1893..	7	4	2	3	2	6	3	4	0
1880..	4	2	1	2	5	5	4	8	0	1894..	7	4	2	0	1	6	7	3	0
1881..	8	3	1	1	3	9	2	3	1	1895..	7	2	1	1	3	4	5	8	0
1882..	7	8	2	2	3	4	2	3	0	1896..	12	3	1	1	2	4	4	4	0
1883..	11	5	2	1	5	2	1	4	0	1897..	8	9	0	2	2	4	3	3	0
1884..	7	2	0	0	2	9	3	7	1	1898..	8	4	1	2	5	3	4	3	1
1885..	5	5	2	2	5	4	3	4	1	1899..	8	8	1	3	2	4	3	1	1
1886..	4	9	1	1	4	4	2	4	2	1900..	8	7	1	2	1	4	3	5	0

Commenting on the preceding communication, Mr. Harvey M. Watts writes to the Editor as follows:

This is a very interesting contribution, although I do not at all agree with Mr. T. H. Davis in the conclusions that he has drawn from the study of the minutiæ of local wind movements. As is very apparent all through the year, our warm spells on the Atlantic coast are due to an aerial mechanism which consists primarily in high pressures over the Southern States, particularly over the Gulf of Charleston and even farther north, in conjunction with low pressures in the northwest or north. This mechanism is so regular in its effects that I do not think that any study of local winds can in any way controvert it. Perhaps I lay too much stress on the anticyclone itself, but the condition which best favors the warm waves is when the continental anticyclone has moved down over the Gulf of Charleston, and is there seemingly held up by merging with the general anticyclone of the Atlantic basin. I am also sure that investigations will show that the climatic variations which seem so anomalous are due to the strengthening of the tropical anticyclonic belts which in turn affect the paths taken by the continental cyclones and anticyclones, which in turn determine seasonal variations.

As neither Mr. Davis nor Mr. Watts has told us what data were used in compiling the maximum frequency or prevailing direction of the wind, the Editor would remark that the frequency of the wind directions during any month will differ according as we study observations made at one or another hour of the day. No general statement as to relative frequency can be made except after eliminating the diurnal change. The isobars in the eastern part of the United States do not change very much diurnally, whereas the winds do so. Thus, on the Atlantic coast we may have a strong sea breeze by day and land breeze at night, while the general isobars are calling for a steady southeast or southwest wind. A station that is subject to land and sea breezes or to lowland and mountain breezes is, therefore, not in a position to give us a fair idea of the relation between isobars and winds unless we eliminate the diurnal variation of the wind. These remarks may be illustrated by Table 2, which gives the frequency of each wind direction during October, 1901, as shown by hourly observations (see Annual Report, Chief of Weather Bureau, 1901–2, p. 43); by observations at 8 a. m. and 8 p. m. (see Annual Report, p. 117), and by observations at 8 a. m. only (see the published morning weather maps).

TABLE 2.—*Wind frequency.*

Wind direction.	New York.			Boston.			Philadelphia.			Washington.		
	24 hours.	8 a. m. 8 p. m.	8 a. m.	24 hours.	8 a. m. 8 p. m.	8 a. m.	24 hours.	8 a. m. 8 p. m.	8 a. m.	24 hours.	8 a. m. 8 p. m.	8 a. m.
North	40	4	3	38	6	3	84	6	3	55	6	3
Northeast	54	7	6	8	0	0	57	4	6	79	6	4
East	34	3	1	41	1	1	44	2	2	52	3	3
Southeast	76	5	1	38	4	1	73	8	1	126	9	3
South	76	8	1	74	8	3	82	8	1	114	10	5
Southwest	183	14	11	215	15	7	146	10	8	39	2	2
West	64	5	1	146	14	5	114	12	2	36	1	1
Northwest	217	16	7	184	14	11	143	11	8	192	20	10
Calm	0	0	0	0	0	0	1	1	0	51	5	0

The most frequent directions for October as given by our authorities are as follows:

TABLE 3.

Station.	Weather Bureau records.			Davis' Tables.	Watts' Chart.
	24 hours.	8 a. m. 8 p. m.	8 a. m.		
Boston	SW.	SW.	NW.	W.	SE.
New Haven	....	....	....	SW.	E. of S. or SSE.
New York	NW.	NW.	SW.	W.	E of S.
Philadelphia	SW.	W.	SW., NW.	NW.	W. of S.
Washington	NW.	NW.	NW.	....	SSW.

But the count of hourly frequencies and the charting of "most frequent" winds in connection with the monthly isobars tell us very little. The trend of an isobar and the trend of the wind that accompanies it are closely connected as cause and effect. These trends, occurring simultaneously and associated together, must be recorded daily and studied together; this still remains to be done for the United States, and this work can not be properly replaced by the study of charts of most frequent winds, or even of resultant winds, and average isobars.

There can be no doubt that the "tropical high" of the North Atlantic is subject to large changes in position and intensity.—*C. A.*

THE FRANCO-SCANDINAVIAN STATION FOR AERIAL SOUNDINGS.

By LEON TEISSERENC DE BORT, dated Viborg, April, 1903.

Since it has been proved by the exploration of the meteorological phenomena of the free air, by means of balloons and kites, that the sudden and accidental variations that we are able to observe at the surface of the ground also occur at considerable heights, the utility of continuous explorations and, indeed, the necessity for such investigations have been recognized, if we wish to obtain an accurate conception of the great atmospheric disturbances. Until very recently we have had very little data of this kind, since the use of sounding balloons necessarily excludes continuity and the scientists who have sent up kites have always been careful to avoid unfavorable conditions, as this latter method is too delicate and costly to risk apparatus when the conditions render a catastrophe probable. However, the results obtained by M. Teisserenc de Bort at his observatory at Trappes, by very frequent investigations, notably from January 27 to March 1, 1901, have proved that continuity is the most important matter and worthy of every effort. This is the reason why, in consequence of a report addressed by Teisserenc de Bort to M. Mascart, Director of the French Meteorological Service, the latter invited the meteorological institutions of Sweden and Denmark to unite in a scientific enterprise, in order to make meteorological investigations of this kind.

The delegates of the three countries, Messrs. Teisserenc de Bort, Hildebrandsson, and Paulsen met in the month of May, 1902, and chose as the seat of this experiment an extensive moor situated about 10 kilometers from the City of Viborg, in Jutland (latitude, 56.5° north; longitude, 9.2° east). This is a region where barometric depressions are of very frequent occurrence, and where the orography lends itself admirably to the maneuvers necessary in sending up kites. The proprietor, Mr. Krabbe, master of the hounds to the Court of Denmark, kindly offered to the expedition the use of the ground and his own personal assistance in the erection of the buildings and the making of contracts with the merchants and manufacturers of that region. Thanks to his zeal and devotion, the buildings were put up very rapidly. The preliminary investigations began in the month of June, and since the month of August the meteorological work has been carried on almost continuously. As this is the first undertaking of the kind, some details of the organization of the work may be of interest.

As already stated, the station is some distance from Viborg, which is, however, the nearest railway station. For investigations of this kind it is, of course, necessary to get away from railroads in order to avoid accidents and difficulties. It was also desirable to avoid being too near to the ocean, as that would entail the loss of a great number of instruments and kites.

The meteorological center of the station is an elevated tower on a hill, 11 meters in height, about 200 meters from the other buildings. This tower was constructed at Stockholm, according to the design of M. Teisserenc de Bort, and transported to Viborg. It is 10 meters in height and open on one side; it turns upon two circular rails so that it can face in any direction. Care is taken to turn the open side away from the wind. The building is of two stories; on the ground floor is the apparatus necessary for the kite service. On one side a small cottage has been provided for the meteorologist on duty. There he has under his eyes a self-registering barometer, and the recording apparatus of an anemometer which is on the roof of the tower. At the farthest side of the large room a table and tools for the construction and repair of the kites are placed, so that the workmen may be employed on such work when they are not necessary at the windlass. In the front portion of this room there are two windlasses, each furnished with a line of steel wire, composed of wires increasing in size from 0.6 millimeter to 1.3 millimeters in diameter, according to the system invented by Teisserenc de Bort, and which has been in use for a long time at the Trappes Observatory. At the top of the line there is a buckle which is attached to the first kite. About 150 meters below it the instrument for recording the meteorological elements is attached. The attachment is made either by means of a clamp or by a ligature. The ligatures serve to fasten together two ends of wire, either of the same or of different dimensions; they are made as follows: The two ends of the wire are twisted in the form of a spiral, and these spirals are entwined one inside of the other. There is on the average about one ligature for every 500 meters of wire, and if need be other kites are hooked on when the angle of the line becomes too weak. The two windlasses are worked by a small electric dynamo which receives its current from a generator placed in a small building alongside of the other houses and driven by a steam engine of 12 horsepower.

The first story of the tower serves as a storehouse for the kites. There are quite a number there of different dimensions, calculated for use in winds of greater or less force, and all ready to be hooked on to the line.

The other buildings consist of a balloon shed, a workshop for the construction of kites and self-registering instruments, and some sleeping rooms for a part of the personnel, kitchen, offices, a large room for testing the instruments, etc., stables and carriage houses, a small house for the steam engine with a bedroom for the mechanicians. Finally, the director of the station, M. Teisserenc de Bort, occupies a small cottage which he has built near the workshops.

As the principal object of the expedition is continuity in the observations, the service has to be carried on day and night, and this requires quite a numerous personnel. The three countries are represented by scientific assistants, two French, two Swedes, and one Dane, a lieutenant-colonel in the Danish army. There are besides a computer and a noncommissioned officer of the Swedish navy, attached to the station by the Minister of the Navy. For the construction of the instruments there are two French mechanicians from the observatory of dynamic meteorology and two Danish clock makers. Eight workmen are employed at the windlasses, a French cabinet maker, and a foreman who directs the work of construction and repairs, a chief constructor of kites, assisted by from four to six carpenters is charged with providing for the needs of this service; two mechanicans keep the motor in working order. To these there must also be added a coachman, a seamstress to sew the kites and two women cooks.

The principal work is the sending up of the kites. Every day when there is sufficient wind—and the wind does not often fail at this place—an ascension must be made. The scientific assistants relieve each other at the windlass as chiefs of service, each one being on duty from eight to nine hours; in the same way the workmen are organized into sets of twos. An ascension begins as soon as the wind allows of it. The self-registering instrument records the barometric pressure, the temperature, the humidity, and the force of the wind. The observations at the surface of the ground are made every half hour. The ascension continues until the cable is all played out or until the descent is rendered necessary either by a rupture of the wire or for any other reason. The dynamo is then set in motion, which is a signal for the mechanician to start the steam engine, which is kept under pressure day and night, and the cable begins to wind itself up. If the instrument is successfully brought down without damage, another one, already prepared for that purpose, is immediately hooked on, and a new ascension is begun without its being necessary to bring down the top kite. As soon as the instrument descends, the work of comparison, the abstract of the curves, and the tabulation of the results are begun in the bureaus. In the

case of a breakage, it is necessary to wait until the instrument is brought back, which requires generally two or three days. For this purpose a letter attached to the basket containing the instrument tells the finder where to send it, and offers him a reward of 7 francs. It happens sometimes, however, that strong winds carry a line of several kilometers in length, with half a dozen kites and the self-registering instrument away to very great distances. In this connection, it may be interesting to cite two cases in particular where the kites crossed the sea.

In the first instance a west-northwest wind broke the line, and after remaining several days without any tidings of the instrument, the conviction gained that it had fallen into the sea in the direction of Aarhuus, in Jutland, and it was given up for lost. Sometime later a letter was received, which announced that a self-registering instrument had been found to the north of the island of Seeland (or Zealand). At first it was supposed that it was an instrument from a sounding balloon, but when it was received it was found to be one which had broken away with the line about twelve days before. Consequently, the kites, after having fallen into the sea on the east coast of Jutland, had crossed the Cattegat, and gone about 150 kilometers from their starting point.

The second instance is still more curious. After a breakage, in a southwest wind, and several weeks having elapsed without any tidings of the lost line, a dispatch was received from Christiansund in southern Norway, announcing that a kite of a certain number had been found near the coast. On examining the diary of the ascension, it was ascertained that the said kite had been attached to the lost line, but below the self-register; the hope was therefore entertained that the upper kite and the apparatus had been carried still farther away and would still be found, and this also happened. The apparatus having been recovered, the different phases of this journey of more than 200 kilometers, over the plains of Jutland and the Skagerack, could be traced by means of the curves.

A consideration of all the ascensions shows that in these countries it is very easy to attain heights of 1500 to 2000 meters, as the wind is generally sufficiently strong in the lower strata. On the other hand, ascensions to great heights, 3000 to 4000 meters, are relatively rare, notwithstanding all the efforts that have been made to attain them. This would tend to prove that the mean velocity of the wind, which is very great near the ground, approaches more nearly to the ordinary rate in the higher strata. It may also be stated that the difficulties and the cost of materials increase enormously when it is intended to make ascensions in all kinds of weather. In fact, it very often happens that in rather strong winds the tension on the line increases in proportion as the wire is unwound, while the angle of inclination of the wire constantly diminishes. In order to ascend higher we are forced to add another kite, and although care is taken in such cases to provide them with a copper wire "casse" which breaks when the pressure of the wind becomes too great, yet we see the total tension steadily increasing and finally attaining the breaking limit without the kites being detached. In spite of all possible precautions, ruptures are still numerous, and it has happened that more than 14,000 meters of the steel wire, 15 kites, and 3 instruments (which, however, were afterwards recovered) have been lost in less than twenty-four hours. It may, therefore, easily be imagined that under these circumstances the service of continuous ascensions becomes very difficult.

In addition to the kite ascensions, sounding balloons for the exploration of the middle strata of the atmosphere are also sent up. As it has been impossible to obtain hydrogen gas on reasonable terms, the balloons have had to be filled with illuminating gas. This has been found sufficient, as there was no intention of sending them up to great heights. The small area of the country makes it necessary to restrict the duration of the ascensions to twenty minutes or half an hour if one does not wish to run the risk of the balloons falling into the sea, and this is the reason why the balloons attain only relatively low altitudes (5 to 8 kilometers). The gas, manufactured at the gas works of Viborg, is brought in a large reservoir balloon made of cloth and sufficiently heavy to counteract its ascending power. It is brought on a wagon constructed for that purpose, and the gas is passed into balloons made of "papile," sent from the Trappes Observatory and which hold about thirty cubic meters. On an average one balloon is sent up every two days, and in special cases one every day. A clock movement tears them open after a certain interval of time, and a letter promises 14 francs[1] to the person who finds the instrument and returns it. Nearly all the instruments have been recovered, and the curves thus obtained complete the data obtained simultaneously by the kite ascensions. In a great number of cases at Trappes sounding balloons have been sent up the same day, and this gives very interesting points of comparison.

Finally, in cases where there has been no wind for a certain length of time a balloon kite has been used, although very rarely. The illuminating gas does not, however, suffice to make it rise, and it has served especially as a kite having no weight; it has, however, been quite interesting from a technical point of view to confirm the utility of such an apparatus. However, on account of the great difficulties attending the preparation and the maneuvers of this apparatus, we have not been able to study it very thoroughly, and the prevalence of strong winds has rendered its use unnecessary.

The experience gained during nine months of work at this station has led to interesting conclusions from a theoretical as well as from a technical point of view. The tables of the results obtained have been printed promptly in instalments and will be published, it is hoped, a few weeks after the observations have ceased. It has been demonstrated that there would be a great advantage in being able to modify the force of the wind artificially when it is insufficient, but especially when it is too strong. This is the reason why a small maritime expedition in Danish waters is being prepared, which is to conclude this work. The Danish navy has placed a gunboat at the service of the expedition for about three weeks.

On the whole, it may be considered that the work done at the Franco-Scandinavian station is a great step toward the end in view: continuity in observations of this kind. There were some periods of an absolute continuity of seventy-two hours, and several times it was possible to study the different phases of the barometric depressions which passed over that region.

NOTE ON THE RADIATION FORMULAS AND ON THE PRINCIPLES OF THERMOMETRY.

By Edgar Buckingham, Bureau of Soils, United States Department of Agriculture.

On page 561 of the Monthly Weather Review for December, 1902, there are certain statements which, it seems to the writer, should not be allowed to pass without comment. In the second column (lines 23–29) it is stated that "Since J_o is the integral of the area of the curve of energy intensity, it should evidently be greater than J_m under all circumstances, but the fact that by this formula (IV) it becomes less for temperatures above 4119° seems to indicate that there may be something wrong in the deduction of formula III for J_m and II for J_o, from which IV for $\frac{J_m}{J_o}$ was derived."[2] This sentence suggests several remarks.

[1] About $2.80.

[2] The equations in question are,

$$\text{II. } J_o = \text{const} \times T^4; \quad \text{III. } J_m = \frac{c_1\, 5^5}{c_2\, 10^{5M}}\, T^5; \quad \text{IV. } \frac{J_m}{J_o} = \text{const} \times T.$$

In the first place, the author is basing his work on Wien's formula,

(1) $$J = c_1 \lambda^{-5} e^{-c_2/\lambda\theta}.$$

The theoretical basis of this formula is of no great value, and its originator himself does not pretend that it is.[3] Furthermore, it has been shown very conclusively[4] that even regarded as an empirical interpolation formula, the equation represents the observed values only for a limited range, and fails completely for large values of $(\lambda\theta)$. It would not be surprising, then, to find ourselves led into error by trying to use the formula outside its known limits of application. Of the various equations which have been devised for representing the distribution of energy in the spectrum of a black body, Planck's latest formula,[5]

$$J = c_1 \lambda^{-5} (e^{c_2/\lambda\theta} - 1)^{-1},$$

seems to be the best up to the present time. But let us take the formula (1) as representing correctly the energy J as a function of the wave length λ and the absolute temperature θ. Making this assumption, the other equations in question may be deduced very easily. By taking the logarithms of both sides, differentiating, and equating to zero, we arrive at once at the equation

(2) $$\lambda_m \theta = \frac{c_2}{5}, \qquad \text{(Equation V.)}$$

where λ_m is the wave length for which J is a maximum.

By substituting this value of λ_m in the original equation (1), we get J_m, the value of J corresponding to λ_m,

(3) $$J_m = \left(\frac{5}{e}\right)^5 \cdot \frac{c_1}{c_2^5} \cdot \theta^5. \qquad \text{(Equation III.)}$$

The equation for Stefan's law may also be obtained from (1), as follows: Since J_o is the total temperature radiation in unit time from unit surface of a black body at the absolute temperature θ, we have

(4) $$J_o = \int_o^\infty J d\lambda = c_1 \int_o^\infty \lambda^{-5} e^{-c_2/\lambda\theta} d\lambda.$$

Substitute in this equation $x = \lambda^{-1}$, and use the easily obtained integration formula

$$\int x^n e^{ax} dx = \frac{x^n e^{ax}}{a} - \frac{n}{a} \int x^{n-1} e^{ax} dx.$$

By carrying this through and taking the value from $x = \infty$ to $x = 0$, the reader will at once find that

(5) $$J_o = \frac{6 c_1}{c_2^4} \cdot \theta^4. \qquad \text{(Equation II.)}$$

The author's equations II and III are therefore entirely correct in form. (I have not gone over the arithmetical work, which is of no importance here.) They are mathematical deductions, with no further hypotheses, from Wien's equation (1), and are correct if that is correct, as we are now assuming it to be. From these two equations we at once obtain the equation

(6) $$\frac{J_m}{J_o} = \frac{5^5}{6e^5} \cdot \frac{1}{c_2} \cdot \theta. \qquad \text{(Equation IV.)}$$

Equation IV, then, is correct, in form at least. The difficulty is not in the deductions of the equations, which are well known, but in the author's interpretation of them.

It is perfectly obvious that no matter what the values of the constants in (6) may be, we may make $\frac{J_m}{J_o}$ as large as we please, by making θ large enough. It is equally obvious that J_m and J_o are not of the same dimensions; and confusion has arisen from accidentally overlooking this fact. In more everyday language, and using the common graphical representation, J_m is the maximum ordinate of a curve and J_o is its area. Putting it in this way, any one will admit that there is no necessary relation between the numerical values of these two quantities, or, in other words, that their ratio depends, for a given form of curve, entirely upon the units adopted, and may be made as small or as large as we please by merely changing the unit of length.

To work out the dimensions of all the equations concerned is easy, but requires more space than should be taken here. I will, however, give a table of the dimensional equations in question, which the reader may easily verify at his leisure. For brevity, I use $[W]$ instead of $[m l^2 t^{-2}]$ as the dimensions of energy.

$$[c_1] = [W l^2 t^{-1}],$$
$$[c_2] = [l\theta],$$
$$[J_m] = [J] = [W l^{-3} t^{-1}],$$
$$[J_o] = [W l^{-2} t^{-1}],$$
$$\left[\frac{J_m}{J_o}\right] = [l^{-1}]$$

A few lines farther on, occur some suggestions as to the propriety of extrapolation, by means of certain formulæ, to temperatures as high as 8000°.

"Temperature" is a much abused word, and the expression "measurement of temperature" is one which is too often used very loosely. There is no such thing as "measuring" temperature in the sense in which the term measuring is commonly used in physics, i. e., there is no such thing as direct comparison of two intervals of temperature which are not coincident at both ends. We have a simple and general criterion for deciding whether the temperatures of two bodies are equal or unequal; and by a further convention we tell, with certainty, what is the sign of the difference in temperature of two bodies. But the mere fact that we speak of the body which cools off as having the *higher* temperature far more often than we speak of it as having the *greater* temperature, betrays the fact that we do not look upon temperature as a quantity measurable in the usual sense.

When we go beyond the bare statement that the temperature of one body is equal to, lower (less) than, or higher (greater) than that of a second body, and assign numerical values to temperature, we are, properly speaking, not measuring temperatures, but *numbering* them. In other words, we adopt some method by which we may assign to each separate temperature a definite number, and there must be a one-to-one correspondence. The method must be unequivocal, in assigning one and only one number to each temperature, and in never giving the same number to two different temperatures. This is the one essential, fundamental principle in constructing a scale of temperature. If we conform to it, we are free in other respects to choose our scale as we please, the choice being, in any case, arbitrary.

One particular scale, Lord Kelvin's, is based upon the two laws of thermodynamics, which are, so far as we now know, general and exact. It is independent of the properties of any particular material substance, and may, therefore, with propriety be called an absolute scale, though other scales might be devised which would be equally deserving of the name. This scale is difficult to use, and for all ordinary practical purposes in physics, it is replaced by another which is certainly not very different from it between the limits of 0° and 100° on the centigrade scale. This is, of course, the international normal scale of the constant volume hydrogen thermometer. There is much talk about temperatures of —200°, etc., "on the absolute scale," but as a matter of fact, we are not *sure* of the value to be assigned to any temperature on Lord Kelvin's scale—the only "absolute" one in use—except within narrow limits, though there we may assign values

[3] W. Wien, Ann. d. Phys., (4), *3*, 530, 1900.

[4] Rubens and Kurlbaum, Ann. d. Phys., (4), *4*, 649, 1901.

[5] Planck, Ann. d. Phys., (4), *4*, 553, 1901. Rubens and Kurlbaum, loc. cit.

with the practical certainty that our assignment is only slightly in error.

It is easily shown by thermodynamics that Lord Kelvin's scale is identical with the scale of that nonexistent body, the ideal gas. This substance is defined by the equations

$$(pv)_\theta = \text{const},$$
$$c_v = \text{const},$$
$$\lambda = 0,$$

where p = pressure, v = volume, θ = temperature, c_v = specific heat at constant volume, and λ is the heat effect during free expansion. The determination of the relation of the international scale, or any other gas scale, to Lord Kelvin's scale depends upon the exact knowledge of the variations of the properties of the gas from those of the ideal gas as referred to above. We have no such knowledge for low temperatures, and therefore we are unable, as yet, to make any positive statement regarding "absolute temperatures" below the centigrade zero.

At the other side of the interval of more or less positive knowledge we are, for a certain distance at least, somewhat better off. We may say that gases appear to approximate more nearly to the ideal state as the temperature rises. Therefore, while waiting for more data, especially on the Joule-Thomson effect at greater ranges of temperature, we may have strong hopes that the international scale, even at high temperatures, is not far divergent from Lord Kelvin's scale, our most secure basis for theoretical work. But the gas scale has an upper limit, imposed by the impossibility of procuring a material for the containing vessel, the bulb of the thermometer. Even by giving up the strict adherence to the international scale and substituting nitrogen for hydrogen, it has only been possible to use the gas thermometer with any approach to accuracy up to about 1450°. Above that temperature it is useless to speak of temperatures by the gas scale, because we can not determine them. It is, of course, probable that in time somewhat more refractory materials will be found, so that the upper limit of the gas scale will be somewhat raised; but to pass over this comparatively small advance that may reasonably be expected, suppose we go at once to temperatures approaching that of the electric arc. Not the slightest prospect is in sight that we shall ever determine such temperatures by the gas scale.

What, then, do we mean when we speak of "extrapolating to temperatures of 7000° or 8000°"? The question whether an extrapolation is or is not "allowable," loses all meaning unless we have some means of defining, physically and not merely mathematically, the quantity of which we are finding the value by extrapolation, and a prospect, however distant, of finding out by *direct experiment* whether the extrapolation is allowable or not. If there is no such prospect, the word "extrapolation" is a misnomer. The extrapolation formula is nothing but a new definition of temperature, so arranged as to coincide with some previous definition throughout the range of that previous definition, but independent and standing on its own merits, outside the limits where the validity of the former definition ceases. Thus, one may with some propriety (though perhaps a rather doubtful one) speak of using the thermo-couple to determine temperatures by "extrapolation," because its range is not so much higher than that of the gas thermometer as to preclude all prospect of the possibility of following the thermo-couple with the gas thermometer; but it is, in the writer's opinion, better, even in this case, to admit frankly that, having decided upon a particular thermo couple, and having adopted a formula which connects its indications, at lower temperatures, with those of the gas thermometer, this couple and its formula define a scale of temperature which is for the present independent, though in no sense absolute.

But at such far higher temperatures as we can produce by the electric arc, all our ordinary scales fail, and there is no prospect of their ever doing any service; we are driven to define temperature in some manner independently of the properties, or even the existence of rigid bodies at those temperatures. The most obvious way of doing this, is to turn to the phenomena of radiation, and then, whatever formula we adopt, that formula, together with the *measurable* phenomena to which it refers, constitute a new and independent scale of temperature which may be made to coincide with some other and more familiar scale at some lower ranges of temperature, but which is, nevertheless, in no proper physical sense an extrapolation.

If such a definition can be based securely, and *with no further assumptions of any sort*, upon the laws of thermodynamics, then it is reducible to, and in a mathematical sense equivalent to, Lord Kelvin's scale. If it is founded upon any other principle or principles as general, as exact, and as independent of the properties of particular substances as those two principles appear to be, then it is a new absolute scale. But unless the scale can be defined in some such manner as warrants our giving it the appellation of "absolute," in the sense in which that term has been used in this note, it remains an arbitrary scale, not reducible to any scale of which we have perfect cognizance at such lower temperatures as are ordinarily within our reach.

Our conclusion is, therefore, that it is not allowable to speak of extrapolation to 8000°. Either the scale is an absolute one, valid and having a definite meaning through all ranges where the laws of physics hold, so that there is no need of extrapolation, or the scale is an arbitrary one. If it is arbitrary, it may, as the scale of the thermo-couple may be made to do, coincide with some other scale within a more limited range, but that does not make it an extrapolation formula. If we are not willing to regard the two scales as independent, we can only consider the one of shorter range as being, in a sense, a special and limited case of the one of wider range.

THE INFLUENCE OF LIGHT AND DARKNESS UPON GROWTH AND DEVELOPMENT.

By DANIEL TREMBLY MACDOUGAL, Ph. D., Director of the Laboratories, New York Botanical Garden.

SUMMARY.

By RAYMOND H. POND, Ph. D., dated Sterling, Ill., May 25, 1903.

In the above-mentioned memoir of over three hundred pages (large 8vo.) Professor MacDougal has recorded the most efficient investigation ever made of the influence of light and darkness upon growth and development. The subjects included are, first, the literature, of which a most thorough study is evident; second, experiments in detail with most admirable and appropriate illustrations, including graphic representation of measurements; third, general considerations, comprising critical discussion of experimental data and their interpretation.

The history of physiological investigation reveals the fact that some attention was given to the influence of light upon growth as early as the seventeenth century, but no epoch-making researches were made until the middle of the last century when Sachs undertook his extensive study of the problem. Since the time of Sachs the literature has rapidly accumulated and the failure of previous investigators to reach the conclusions now demonstrated is to be attributed to insufficient and unreliable data as well as to prevailing ignorance of the phenomena of irritability. During a period of seven years, a large part of which was spent working under especially designed facilities, Dr. MacDougal has perfected the technique and accumulated reliable data. Ninety-seven species of plants representing the various systematic groups and covering a wide diversity of growth conditions have been experimented on.

I.—GENERAL CONSIDERATIONS.

Modes of influence of light upon plants.—As a basis for the

critical discussion of data experimentally obtained, several pages are devoted to a careful consideration of the various relations sustained by radiant energy, in the form of light, to the physiology of plant life. A distinction must be made between the influence of light upon substances which may be isolated from plant protoplasm and the influence of light upon substances actually concerned in the physiological processes of the living cell. The different changes which may be induced in the latter, are probably less numerous, but certain ones may be regarded as undoubtedly occurring. Among these may be mentioned the oxidation which is known to occur when bacteria are killed by exposure to light; likewise the changes which take place in the enzymes present in the protoplasm.

As in the case of chlorophyl-formation, solar radiation may act as a stimulus to initiate processes without furnishing energy for their operation. As far as available data are concerned, the author believes that the only way in which light might directly influence growth, would be to diminish the production of enzymes essential to the process. It is certainly true that with many plants the rate of growth diminishes under illumination, but a careful consideration of all available data, including that established by earlier investigation, fails to reveal a single instance in which light has directly a paratonic or retarding effect upon growth. On the other hand, well established instances are known in which growth is accelerated when natural illumination is supplemented by artificial light during the night. In such cases, or when plants are removed to Arctic regions for growth under the constant illumination of the Arctic sun, the result to the plant is simply a shortening of its ordinary vegetative period. The denial of customary nocturnal rests, does not result in any distinct modification of structure beyond some slight attenuations in various organs, although some physiological processes seem to be accelerated; at least, certain substances are produced in larger proportion.

In growing toward the light a plant may be seeking not benefit from illumination but the advantages of accompanying conditions which favor its multiplication of individuals. Thus, seeds and spores, which in general are not supposed to be benefited by illumination, secure conditions favorable for dissemination when the reproductive organs are directed toward the light. Moreover, the response to light stimulus may result in enabling the plant to regulate certain physiological processes, such as excessive transpiration. That such reactions are directly caused by the influence of light on the enzymes or other cell constituents, has not thus far been proven.

For each plant there is a minimum, optimum, and maximnm intensity of illumination and the length of stem and branch as well as area of leaf surface is, in many species, dependent upon the intensity of illumination. When the intensity of light results in changing the normal stature or extent of leaf surface, modifications of internal structure are likely to occur in response to the disturbed conditions of transpiration or the necessity for mechanical adjustment of the tissues.

The consequences of constant darkness are very marked in comparison with those of continuous illumination. Under constant darkness the inherent tendencies of the plant come to expression, except as modified by gravitation stimulus. Any influence of light to produce modifications in the form of organs or in internal structure, is absent. Thus the necessity for careful consideration of the life habit and nutrition of a plant in the interpretation of its etiolation phenomena becomes apparent. Plants which are accustomed to make their own food by the aid of solar radiation are, under darkness, limited to such nourishment as may be stored in the tissues when the etiolation commences. The stored food is intended to nourish the plant during periods when it is unable to make food for itself, and in amount usually exceeds the probable requirements of such periods, but when light is denied for the entire vegetative season, marked modifications in vegetative form and structure are to be anticipated.

Atrophy may be a consequence of such conditions. Some organs may be suppressed in their development and the tissues used for conveying the nutritive juices of the plant may show marked alterations. The amount of water passing through the tissues is greatly diminished as well as the volume of vapor exhaled from the surface openings. In some plants stomata fail to develop in continued darkness and in such cases the movement of water through the plant is greatly checked. Such consequences of continued darkness are regarded as negative effects to be distinguished from a probable direct influence of darkness, per se, upon the plant.

Underground stems.—When bulbs, tubers, corms, and rhizomes are kept in darkness for the entire vegetative period, quantitative alterations result as an expression of limited food supply. Storage and propagative organs are formed at the close of the season, but they are smaller than the corresponding organs of the parent.

Water plants.—The etiolation of aquatic plants are difficult to interpret because of an apparent tendency to adapt length of stem and leaf stalk to depth of water independently of light influence. Some rooting aquatics were found to exhibit an elongation of petioles and stems in darkness and it seems fairly certain that water plants which send up shoots regardless of the precise water level, correspond with terrestrial species in their response to etiolative conditions. *Philotria canadensis* and *Ceratophyllum* under etiolation show an elongation in internodes even though floating freely.

Endurance of organs and plants under etiolation.—An effort to determine the maximum endurance of plants under continuous darkness was not made, but some cases of extraordinary endurance were observed. Temperature and moisture are very potent factors in determining the endurance under such conditions. Plants vary greatly in their behavior under such environment. In some, as with *Æsculus* and *Hicoria*, the young plants developed an unusual number of internodes whose leaves quickly succumbed, manifesting a constant economy of material in the endeavor to reach the light. In one case a cocoanut made continuous growth for fifteen months using in this time only one-half the stored food supply. In the case of *Canna* the number of foliar organs produced was far in excess of the normal. Plants like *Apios* and *Aristolochia*, which are accustomed to seasonal rest periods, show a characteristic behavior in that the material used to develop etiolated shoots is withdrawn into the storage organ when the etiolated stems die, so that there is no loss of substance except that oxidized in respiration. In underground organs which develop apical buds as in *Arisæma*, *Podophyllum*, and *Pteris*, the old storage organ separates at the close of the vegetative season leaving a new portion like the old. In such cases, attempts to endure may be seasonally repeated and in the case of *Arisæma* an effort was made to persist during four vegetative seasons. With *Arisæma* the proportion of water in the new shoots increases each season, while that in the corms decreases. The potato is capable of forming tubers the second vegetative season under etiolation.

Climbing plants.—In some species only the basal internodes elongate under etiolation, while in others the median ones lengthen more than the basal or apical internodes. It is believed that the number of internodes is not increased over the normal in the case of twining plants though it may remain below normal in some cases. The power of etiolated climbers to twine has not been proven.

Seedlings.—The endurance of seeds having an endosperm depends upon the amount of stored food and resistance of the seed to decay. *Arisæma triphyllum* is able to vegetate in darkness and for three seasons will make vigorous growth in the

darkness using only nourishment stored in the seed. In *Hicoria*, which has its food stored in the cotyledons, a peculiar behavior was observed in that after vegetating for the usual period the plant passed through a rest period and resumed growth to the extent of adding several branches. The root system of seedlings under etiolation is usually less extensive than normal.

Effect of darkness upon succulents.—Leaves of the century plant, *Agave Americana*, maintained an apparently normal green color for eight months under continuous and absolute darkness. Immature leaves present when the test began continued to grow at the base of the blade, the tissue formed in darkness being, however, pale yellow and etiolated. Leaves which developed wholly in darkness were completely etiolated and reached only one-half the normal size.

Etiolation of stems of woody perennials.—Twelve different species exhibited a similar behavior in that the buds of their terminal portions were very reluctant to awaken in darkness as compared with buds located on the basal portions of the shoot. In the case of *Fagus Americana*, the buds of young plants would awaken under etiolation, but the buds of mature plants refused to awaken except under the stimulative influence of light. Both young and adult plants of this species readily formed calluses under etiolation, and the buds developing from these calluses grew faster than the control and were able to awaken and develop in darkness as also in light.

Etiolation of stems of herbaceous biennials and perennials.—Many species of such plants do not show an unusual lengthening of the shoot, the internodes just about equaling in number and length those of the control plants. Most of these biennials and perennials have considerable stored nourishment and the experiments show in addition to the dependence of the amount of growth upon the quantity of stored nourishment, also a limited endurance due to the incomplete differentiation of the conductive tissues, and also to the fact that the storage organs usually decay and ferment, thus cutting off the food supply. The diminished transpiration is undoubtedly a factor in the development of the conductive tissues.

Generative tissues.—Examination of the internal structure of etiolated stems revealed notable alterations in the anatomy of plants grown in continuous darkness. Very notable is the modification occurring in *Apios*, whose stem diameter increases, forming in addition to the usual generative layer of tissues in the cambium a second one in the region of the pericycle, which is about one-half as thick as the primary layer.

Etiolation of leaves of monocotyledons with parallel venation.—Most of the plants of this type tested have storage organs in the form of tubers and rhizomes. The aerial stem is practically absent, so that the leaves arise abruptly from the underground stem into a more or less vertical position. There is no striking uniformity in the behavior of these plants under etiolation, although there is a common tendency on the part of the leaves to attain normal dimensions or greater with the usual number of open and probably functional stomata. In some cases, length of leaf is developed at the expense of width, the total surface, however, about equaling the normal. Cases of increase in both width and length were noted.

Inherent inclinations of the plant toward torsions and curvatures seemed to be emphasized while in a few cases plants not usually manifesting such tendencies normally, under etiolation, seemed to acquire them. Probably, however, a part of this result is to be attributed to the disturbed mechanical adjustment of the tissues due to suppressed differentiation and consequent excessive development of the fundamental tissue.

Etiolation of petiolate leaves of monocotyledons with open or reticulate venation.—The behavior of the plants of this group shows features strikingly different from those of the preceding group in that the leaf blades do not unfold while the leaf stalks usually reach an unusual length. In the case of leaves without a leaf stalk, there is not any lengthening of the basal portions of the blade.

Effect of etiolation on leaves of dicotyledons.—Species having storage organs in the form of underground stems or bulbs were selected. The members of this group show a uniform behavior in that they fail to develop leaf blades which are normal, either in size or structure. In some instances the length of the blade increased at the expense of the width, so that the superficial area of the blade was approximately normal. Complete differentiation of mesophyll did not occur. The stomata were usually smaller than normal. Petioles and midribs were greatly lengthened. The leaves manifested very little capacity for endurance.

Etiolation of leaves arising from aerial stems.—Leaves of woody perennial stems differ from those of the herbaceous stems rising from the underground organs, in that those of the former do not attain normal dimensions in darkness, though they may fully unfold and expand. The petioles of such leaves do not lengthen considerably as do those of the herbaceous stems. While such general differences may be noted, it is still impossible to say what factors are determinative in the behavior of plants under darkness, and the most that may be mentioned as yet is, that ancestral habit, food supply, structure of shoot, and leaf are potent in effecting the final result. Leaves resemble stems to the extent that tissue differentiation lags in darkness, causing an unusual proportion of undifferentiated or fundamental tissue, and this partial development in tissue is particularly true of those tissues concerned with starch making, and which, under normal conditions, are accustomed to light exposure. If the quality and amount of development made by leaf rudiments during bud formation is regarded as a factor, it would, of course, be necessary to continue etiolations for two seasons in order to secure complete etiolation, and in this latter case it is very doubtful if any plant can develop leaves which are normal in both width and length.

Effect of etiolation upon spores and sporangia of ferns.—The inclination of tissues to remain undifferentiated, as already considered in the higher plants, is very much emphasized by the consequences apparent in the case of ferns. About eight different species belonging to as many different genera were tested, and it seems that the sporogenous tissue remains so undifferentiated as to prevent the formation of sporangia and the maturity of the spores.

II.—MORPHOGENIC INFLUENCE OF LIGHT AND DARKNESS.

Relation of light and darkness to growth and to differentiation and development.—One prevailing consequence of continued darkness among all species excluding degenerates with chlorophyl, is the decrease in tissue differentiation; a distinct tendency of structural elements to remain in primitive condition being manifest. Tissues, which in normal plants of same age are well differentiated, do not appear in the etiolated. Endodermis and pericycle were altogether missing in the aerial members of perfect etiolations. This means, of course, that the primitive or fundamental tissue is present in greater volume in the etiolated plants.

This absence of differentiation often accompanies growth, so far as increase in volume constitutes growth, showing how very distinct the two processes are. It is thus evident that light has a "morphogenetic" or differentiation-inducing influence upon plant tissue; and the phenomena of etiolation are to be regarded as consequences naturally occurring when this "morphogenetic" influence is withdrawn by the substitution of darkness for light.

Consideration of all the theories hitherto advanced to account for the phenomena of etiolation, reveals them to be altogether inadequate in the light of the comprehensive data accumulated by Dr. MacDougal in the course of this investigation. Etiolation itself is not to be regarded as an adaptation

to the absence of light; the extraordinary elongation of stems and branches in darkness is not necessarily an expression of an effort on the part of the plant to reach the light. The phenomena of etiolation are therefore consequences of the withdrawal of the morphogenic influence of light.

Stimulative influence of light.—That light may act as a stimulus to plants has long been known. For each species there is a minimum, optimum, and maximum intensity of radiant energy that may act as a stimulus, so that each species may be regarded as "attuned" to a certain range of light intensity. Development of certain tissues or organs may be entirely suppressed if the plant fails to be exposed to the favorable intensity of illumination. Even the protoplasts may not undergo the customary development if the plant fails to secure exposure to the stimulating intensity required. However, they may continue to multiply as immature elements under the absence of the stimulus necessary to induce their normal transformation. This stimulating influence is not restricted to the particular organ or tissue exposed to it. It may be transmitted causing changes in tissues which were not exposed to illumination while the surfaces which were exposed to the stimulating rays remain unchanged so far as may be determined. Moreover, the stimulating influence may not induce its corresponding consequence immediately, but may remain potential, as it were, producing changes in structure not present in the plant when the stimulus was received. The behavior of *Æsculus* seedlings bears excellent testimony to this latter statement. The seedling of this plant under etiolation does not develop leaves; the foliar organs being represented by mere bracts. If, however, a seedling is allowed to expose its basal internodes to the light and then is confined to darkness, the internodes which develop weeks later will bear leaves.

The results of experiments designed to ascertain the particular influence exerted by certain rays of the spectrum are difficult to interpret. The more refrangible blue violet rays are usually regarded as the ones most effective in producing direction movement, and it is not improbable that these same rays constitute the stimulus which induces morphogenetic or differentiation inducing changes. In all cases the correlation of structure and function must be kept in mind. In some species the leaves are cast away under etiolation and in other species the leaves are retained, making it difficult to say that the shedding of leaves in the former case is an adaptative reaction to the conditions, although it may be, and the reason this does not occur in the latter case is that the organization of the plant disqualifies it to employ such an adaptation.

Likewise, the results obtained by continuous illumination are difficult to interpret in view of the results manifested under discontinuous illumination, and while the generally accepted opinion has been that radiant energy in the form of light may exert a stimulative effect, the supposition may be considered that it may be the influence resulting from an alternation of light and darkness that constitutes the stimulus.

III.—INFLUENCE OF ETIOLATION UPON CHEMICAL COMPOSITION.

Characteristic odors of plants are very much weakened by etiolation, and more delicate flavors may be secured through cultivation in darkness. Economic advantage could no doubt be taken of this fact in many cases, as is now done with some plants, noticeably celery. Cellulose, which resists animal digestion, occurs in diminished proportion in etiolated plants.

Determination of water, dry weight and ash in the case of *Arisæma* showed that the proportion of water present in the corms notably diminishes during the first and second seasons of etiolation; the proportion present in the second being, however, still greater than that in resting corms, air dried at ordinary temperatures. This implies an increased proportion of dry matter, although the actual amount is less. The proportion of ash increases, meaning, of course, the accumulation of incombustible residue. With leaves the water is present in more than normal amount in the first etiolation, and increases during the second season of darkness. The dry matter steadily decreases, while the ash increases.

It is certainly true that etiolated plants absorb mineral salts from the soil.

IV.—RATE AND MODE OF GROWTH AS AFFECTED BY LIGHT AND DARKNESS.

Interpretation of the phenomena exhibited by plants in their periodicity of growth has been by no means uniform. For each plant there is a grand period of growth comprising the interval of gradual acceleration to a maximum rate, and a period of gradual decline to a final minimum rate. The curve which traces this grand period of growth is a very irregular line with many variations presumably dependent upon irregularities in temperature, moisture, or nourishment. In addition to the minor variations mentioned, somewhat rythmically occurring accelerations and retardations may be noted, which are accepted as manifestations of an inherent tendency of the plant. Some investigators have concluded that the rhythmical acceleration and retardation of growth, manifested by plants in the dark room, results as an after effect, or a lingering of the diurnal periodicity, occurring when the plant is naturally exposed to alternation of dry and night. The generally accepted opinion has heretofore been that light has a direct or paratonic effect upon growth, so that the rate of growth increases during the night toward sunrise, and decreases during illumination in daytime. The investigation now at hand, however, shows that the behavior of a given species under etiolation can not be predicted, as would be the case if light per se exerted a universally paratonic influence. The amount of growth, the volume of tissue formed in darkness is much greater so that the stems exceed the normal thickness as well as length in some instances. On the other hand, some species show a decided reduction in the amount and rate of growth under etiolation. The obvious interpretation of these two opposites in behavior is, that darkness as well as light may have a stimulating influence. The stimulative influence of light would account for the tissue differentiation occurring under illumination, while the stimulative influence of darkness would account for the excessive elongation of shoots which occurs in prolonged darkness, and possibly may be regarded as an adaptation phenomenon in some species, indicating an effort by the plant to lift itself beyond an "imaginary obstruction" to illumination. Moreover, when plants are exposed to continuous illumination, that is, when artificial light is used during the night, the amount of growth is greater than in plants naturally exposed to alternation of light and darkness, so that conclusive evidence is now available to demonstrate that light does not have a direct retarding or paratonic influence upon plant growth, nor does radiant energy in the form of light sustain an "invariable and universal relation to increase in length or thickness, or to the multiplication or increase in volume or the separate cells."

The motive of Professor MacDougal in this investigation has been purely scientific rather than economic, but it is to be especially considered that the foundation is now laid for the investigation of problems economically important. Two noteworthy facts of economic significance are mentioned in the memoir, namely, that etiolation may be employed to modify plant flavors and odors and that the proportion of cellulose decreases under etiolation. The latter fact is especially significant because cellulose resists animal digestion, so that vegetables which under light exposure develop a large ratio of this indigestible cellulose be cultivated with proper regard to light conditions so as to become more digestible. Since the particular

influence of light upon a given species can not be predicted, and since every plant is "attuned" to a certain range of light intensity, it is evident that the optimum light conditions must be experimentally determined for each species. As soon as this is ascertained, it will then be a very easy matter in view of the comprehensive data constantly accumulating through the observations of the Weather Bureau, to choose a locality, which is known to furnish optimum light conditions. For many years the Weather Bureau has made extensive observations in various regions, not only as to sunshine and cloudiness, but also more recently, as to the thermal effect of solar radiation. The development of research along the lines indicated will make even more apparent the now well recognized public utility of the important facts continually multiplying through the work of the Weather Bureau.

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physical Geographic Institute.

[For tables see the last page of this REVIEW preceding the charts.]

Notes on the weather.—All over the country, except on the Atlantic coast belt, the weather was unusully dry and close. On the Pacific slope there was a general withering of the vegetation, and owing to the drought and the almost constant wind, the fires, made to burn the fallen trees and trash on newly cleared lands, in many instances spread out, causing serious damage to field and forest. In San José, rain fell on the 23d, 24th, 25th, and 26th, but was scarcely enough to wash away the dust. Pressure and temperature about normal; relative humidity, 66 per cent against 74; sunshine, 255 hours against 205. On the lower hills on the Atlantic watershed, in the San Carlos Valley especially, the scarcity of rain was such that the foliage of the tender plants, growing under the forest shade, was crisp and brittle, and the cacao plantations suffered much damage.

Notes on earthquakes—April 1, 7^h 16^m a. m., slight shock E-W, intensity I, duration 4 seconds. April 2, 10^h 45^m a. m., one shock NW-SE, intensity IV, duration 6 seconds. April 7, 5^h 17^m 45^s, slight shock NNW-SSE, intensity IV, duration 7 seconds. April 20, 3^h 52^m a. m., slight shock NW-SE, intensity II, duration 4 seconds. April 22, 6^h 47^m p. m., tremors NW-SE, intensity I, duration 4 seconds. April 29, 4^h 40^m p. m., slight shock E-W, intensity II, duration 4 seconds. April 30 5^h 00^m a. m., slight shock E-W, intensity II, duration 3 seconds.

CLIMATOLOGY OF TAMPA, FLA.

By ERIC R. MILLER, Observer, United States Weather Bureau, dated Tampa, May 25, 1903.

Tampa, Fla., latitude 27° 57′ north, longitude 82° 27′ west, is situated midway of the west or Gulf coast of the Peninsula of Florida. It is located at the mouth of Hillsborough River on Hillsborough Bay, the right-hand branch of Tampa Bay, and is about 20 miles from the Gulf of Mexico in a direct line and 35 miles from the bar at the entrance to Tampa Bay.

As regards topography, the city lies on rising ground 10 to 40 feet above sea level. The surrounding region is uniformly low and level or slightly rolling, but is not swampy, as a sandy soil provides natural drainage.

The meteorological history of the station begins in 1825 with the commencement of a record of temperature at Fort Brooke, a military post that formerly occupied the site of the City of Tampa. Measurements of rainfall were begun in 1840 and entries of wind direction and cloudiness were added in 1843. These observations, in a region then the seat of strenuous Indian wars, were made by persons whose duties were mainly military and were frequently interrupted by the more important concerns of the moment. It is to be regretted that such lapses occurred at the time of some very important meteorological events, notably the great freeze of 1835, unquestionably the greatest occurrence of its kind since the occupation of Florida by Europeans; it took place in the midst of a hiatus in the record occasioned by the Seminole war. The Fort Brooke record ceased in 1859, or two years before the opening of the civil war; it was resumed in 1869 for three months, and again during the years 1881–2. W. C. Brown, a civil engineer, acting as voluntary observer for the Smithsonian Institution, kept a record of rainfall for a period covering part of the years 1871, 1872, and 1873. Meteorological observations are also known to have been made for the local newspapers before the establishment of the Weather Bureau office, but no records of these observations have been found. A regular station of the Weather Bureau was established in 1890, and records of all elements have been regularly maintained since April 1 of that year.

The accompanying table exhibits some of the climatological elements. The correlation of these data and the causes of their variation may now be briefly noticed. The weather in winter is more or less modified by passing cyclonic and anticyclonic disturbances, while the weather of summer is mainly controlled by the regular diurnal changes, modified frequently by the occurrence of local thunderstorms and rarely by cyclonic disturbances. The effect of this transfer of the control of the weather from the secondary atmospheric disturbances of winter to the local convectional overturnings of summer upon the temperature is seen only in the character of the disturbances of the diurnal march produced by each, and is not apparent in a climatological table. The rainfall has two maxima, the greater in summer at the time of the greatest frequency of thunderstorms, and the lesser in winter, when the increased frequency of cyclonic disturbances is the source of an increased precipitation. The months of least precipitation, April and November, are those wherein one class of disturbance is gaining and the other losing frequency. Both clouds and wind have winter and summer types, the former being the familiar type of the temperate zones, the latter exhibiting the diurnal changes characteristic of the torrid zone.

Few extreme conditions have occurred since the establishment of the Weather Bureau office that record and tradition do not show to have been exceeded in previous years. The highest temperature recorded since 1890 was 96°, on July 8, 1902, and the lowest 19°, on December 29, 1894. A maximum temperature of 98° was recorded at Fort Brooke in 1848, and it is probable that a temperature as low as 12° or 14° was experienced on February 7–8, 1835, when a minimum temperature of 8° was recorded in the northern part of the State. In the past thirteen years the earliest frost in the fall occurred on October 29, 1892; the first killing frost was on December 6, 1895; the last killing frost March 19, 1892, and the latest frost recorded in spring April 7, 1891. Since the establishment of the Weather Bureau station the greatest rainfall was; for a year, 66.93 inches, in 1894; for a month, 17.83 inches, in August, 1898; for twenty-four hours, 6.56 inches, on September 20–21, 1897; 2.45 inches fell in thirty minutes on June 12, 1900, and of this it is estimated that 1 inch fell in five minutes. In the year 1840 a total of 89.86 inches was recorded; of this 24.52 inches fell in July and 23.40 inches in August, a total of 47.92 inches for the two months. There is a local tradition that the low, flat lands of this portion of the State were under water to the depth of from 1 to 4 feet in 1856, when 22.24 inches occurred in July. There were eighteen successive days with rain in 1894, viz, from August 21 to September 7, inclusive. In 1897 from November 11 to December 4, a period of twenty-four days, there was absolutely no rain, and, if one one-hundredth of an inch be not considered, no rain fell for thirty-two days. April, 1856, is recorded as being wholly without rain. Hail has been recorded at the station only twice in thirteen years, but it has been reported from the surrounding districts a number of times. Snow has fallen three times in the history of the station, and

Climatic data for Tampa, Fla., based on thirteen years Weather Bureau records unless otherwise stated.

[Latitude, 27° 57′ north; longitude, 82° 27′ west. Altitude, 34 feet.]

Months.	Temperature. Mean temperature. All records.	Mean temperature. Number of years.	Mean temperature. 13 years, 1890–1903.	Extremes of monthly and annual means. Maximum.	Extremes of monthly and annual means. Minimum.	Mean of all maxima.	Mean of all minima.	Mean daily range.	Mean of monthly and annual extremes. Maximum.	Mean of monthly and annual extremes. Minimum.	Mean monthly and annual range.	Absolute extremes, 13 years. Maximum.	Absolute extremes, 13 years. Minimum.	Mean daily variability.	Humidity. Vapor pressure, 10 years.	Humidity. Relative humidity. Per cent.
January	60.6	42	59.1	63.6	55.0	68.2	50.1	18.0	80	33	47	82	27	4.5	0.389	81
February	62.8	42	61.6	69.0	54.4	70.3	52.9	17.5	80	33	47	86	22	4.6	0.416	81
March	66.9	42	66.6	71.9	62.0	75.7	57.5	18.3	84	41	43	88	32	3.5	0.488	79
April	71.4	42	70.2	73.3	66.6	79.9	60.5	19.4	88	48	39	90	38	2.4	0.512	74
May	76.3	43	76.2	78.2	73.8	85.5	66.9	18.6	91	58	32	93	53	1.8	0.650	75
June	79.9	44	80.1	81.0	78.9	88.8	71.5	17.2	94	66	28	95	64	1.6	0.770	81
July	81.0	44	81.3	82.7	79.8	89.3	73.3	16.1	94	69	25	96	65	1.4	0.817	82
August	80.9	43	81.5	82.3	80.4	89.4	73.5	16.0	94	69	25	95	66	1.4	0.826	83
September	79.5	43	79.7	81.2	77.6	87.7	71.7	16.0	92	65	27	94	54	1.5	0.786	86
October	74.2	41	73.8	77.2	70.0	81.9	65.6	16.3	88	54	35	92	44	2.4	0.648	81
November	67.5	42	67.3	72.0	61.4	76.2	58.3	17.9	84	43	41	87	34	3.4	0.513	81
December	62.0	41	61.4	65.8	58.7	70.3	52.5	17.8	81	34	47	83	19	4.4	0.417	83
Year	71.9	....	71.6	72.8	70.0	80.3	62.9	17.4	95	27	67	(*) 96	(†) 19	2.7	0.602	81

Months.	Rainfall. Average rainfall. All records.	Average rainfall. Number of years.	Average rainfall. 13 yrs.	Monthly and annual extremes. Maximum.	Monthly and annual extremes. Minimum.	Greatest 24 hour rainfall.	Average number of rainy days.	Greatest successive number of days with— Rain.	Greatest successive number of days with— Drought.	Average thunder storms.	Cloudiness. Average 0–10.	Average days. Clear 0–3.	Average days. P't cl'dy 4–7.	Average days. Cloudy 8–10.	Average days with fog.	Wind. Prevailing direction.	Average velocity.	Maximum velocity. Velocity.	Maximum velocity. Direction.
January	2.61	33	2.78	6.45	.28	2.75	8	5	23	1	4.9	10	15	6	2	ne.	6.2	36	sw., s.
February	3.13	32	3.48	6.27	.98	4.06	8	5	14	2	4.9	9	12	7	1	ne.	7.2	49	s.
March	3.00	33	2.91	7.36	.08	2.15	7	8	22	2	4.5	12	13	6	1	ne.	7.0	36	s., sw.
April	1.95	33	2.09	5.38	.16	2.70	6	5	24	2	4.3	13	12	5	0	w.	6.9	42	sw.
May	2.73	34	2.56	6.92	.33	3.36	7	12	16	4	4.5	11	15	5	0	w.	6.4	42	sw.
June	7.66	36	9.02	13.42	4.24	4.55	17	14	7	10	5.5	7	17	6	0	se.	5.7	37	sw.
July	9.56	37	8.14	15.53	2.11	5.16	18	10	8	11	5.6	6	19	6	0	e.	5.3	43	se.
August	9.36	36	8.65	17.83	4.93	3.98	18	18	10	13	5.8	4	20	7	0	se.	5.0	34	se.
September	6.41	34	8.10	17.28	4.80	6.56	17	16	13	6	5.5	7	15	8	0	ne.	5.7	43	ne.
October	2.57	34	3.14	5.11	.36	2.90	8	7	20	1	4.8	12	13	6	0	ne.	6.5	41	se.
November	1.84	34	1.73	3.96	.24	2.90	5	3	24	0	4.5	12	13	5	1	n.	5.9	36	s.
December	2.30	33	1.80	3.40	.54	1.77	7	4	22	0	4.8	12	11	8	1	n.	6.1	40	s.
Year	53.12	....	54.42	66.93	42.06	....	127	18	24	52	5.0	115	175	75	5	ne.	6.2	....	....

* July 8, 1902. † December 29, 1894.

there is said to have been enough for snowballing in 1886. Thunderstorms occurred on no less than eighty-five days during the year 1900, and there were twenty-four days with thunderstorms in the month of August, 1901. As many as four thunderstorms in one day have been observed at the station. The highest velocity the wind attained in recent years was 49 miles, from the south, on February 28, 1902. Tradition recounts gales in 1848 and in 1859 that caused tides in the river at Tampa at least 12 feet higher than it is known to have reached in recent years.

THE FULTON AUTOMATIC RIVER GAGE AT CHATTANOOGA, TENN.[1]

By Prof. WESTON M. FULTON, Local Forecast Official, Weather Bureau.

This apparatus consists of two parts, the recorder, fig. 2, which is at the Weather Bureau station, and the gage, fig. 1, which is located at the river. The latter part consists of a pulley, A, about 8 inches in diameter, and a small gear wheel, F, both mounted upon a shaft, B, which bears upon the supports C, screwed to the base D. Mounted on the same shaft B, and just to the right (as seen in the drawing) of pulley A, is a small pulley about 1 inch in diameter. The end E of the shaft B, is threaded and screws through the support C. The pulley A and the small pulley have threads around their peripheries cut to the same pitch as the threads on the end of the shaft B. A fine brass spring wire, G, is wound around the pulley A; it passes down through a small hole, H, in the base

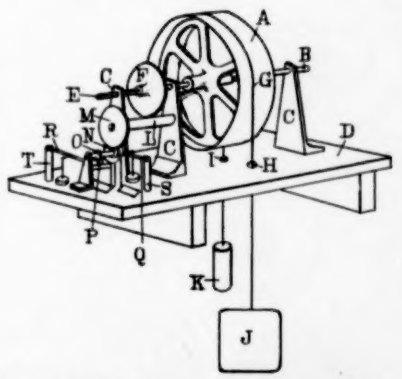


FIG. 1.—The Fulton automatic river gage—the gage.

of the apparatus, and supports the float J. The counterpoise K is in like manner suspended from the small pulley to the right of A, the wire which supports it being so wound upon the pulley that when the float J rises, the counterpoise K will unwind the wire from the small pulley and maintain the wire G taut. The object of the threads on the end E of the shaft B is to give the shaft and pulleys a lateral motion when they revolve, and thus hold the float J and the counterpoise K in the same vertical lines passing through holes in the base B. The gear wheel F, the long pinion L, the gear wheel M, and the pinion N constitute a gear train which so magnifies the motion of the pulley A that when the float, J, moves through a distance of one-tenth of a foot the small shaft O will make one complete revolution. From each end of the shaft O is loosely suspended a bar about 3 inches in length with a crescent-shaped cam attached to its face near the point of suspension. A T-bar, P, attached to shaft O, plays between these pendent

[1] This gage is the invention of Mr. Weston M. Fulton, Official in Charge of the United States Weather Bureau office at Knoxville, Tenn. One of them was installed at Chattanooga, Tenn., during February of the present year, and has been performing very satisfactorily since that time. In response to numerous requests from engineers and others interested, the above description of the gage has been furnished by Mr. Fulton.—ED.

bars, and has thin metal strips oppositely disposed on its two ends, which extend out slightly beyond the ends of the T-bar, so that when the shaft O is rotated in one direction one of these thin strips is pressed away from the T-bar by the pendent bar with which it comes into contact, and thus passes the pendent bar, while the other metal strip is pressed against the T-bar by the other pendent bar, and being thus braced, is enabled to raise the bar. As soon as the latter is raised slightly beyond the vertical position it falls of its own weight and assumes a vertical position again. In the act of falling,

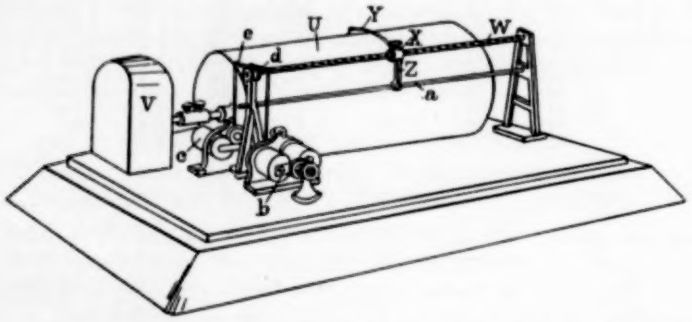


FIG. 2.—The Fulton automatic river gage—office recorder.

the cam on the face of the bar presses down the end of one of the projecting springs Q, R, and plunges the small platinum wire attached thereto into one of the cups of mercury located in the base of the apparatus immediately underneath the projecting springs Q and R. The springs Q, R are supported at their outer ends by the posts S, T. When the shaft O is rotated in the opposite direction, that pendent bar which has hitherto been idle is now brought into action, while the other is allowed to remain idle.

The float J moves in the iron casing which is attached to the face of the bridge pier, and has its lower end below the surface of the water in the river. The counterpoise K is suspended inside of a short iron pipe which is supported immediately underneath the base D, of the apparatus.

Fig. 2 shows the office recorder which is placed on the instrument stand in the observer's office. It consists of a drum, U, which is rotated by the clock V. The shaft W is threaded and carries a nut, X, which supports the pen Y. The bar Z slides along the guide rod a, and prevents the nut X from turning on the shaft W. The electro-magnets b, c operate the pawls d, e, which engage ratchets oppositely disposed on the shaft W. The pawls are so constructed that they act in a manner similar to a clock escapement and thus avoid the possibility of moving the ratchets more than one tooth at a time. The gage is operated over a metallic circuit consisting of three wires. One wire passes through both of the mercury cups, fig. 1, thence through the battery and then connects with one end of the wire in each set of magnets b, c. The other two wires connect with the posts S, T, respectively, and with the other ends of the magnet wires. When the water in the river changes a tenth of a foot, the float J changes its elevation in the casing by the same amount, and this motion causes the pulley A to act through the gear train F, L, M, N, O, and gives one of the pendent bars a complete revolution, thereby closing the electric circuit long enough to move one of the pawls d, e, fig. 2, and thus change the position of the pen on the record sheet which is wound around the drum U. The pawl d operates when the river is falling, while the pawl e operates when it is rising, thus causing the pen Y to move to the right, as seen in fig. 2, when the river rises, and to the left when it falls.

The half tone, fig. 3, shows the general appearance of the apparatus and its accessories.

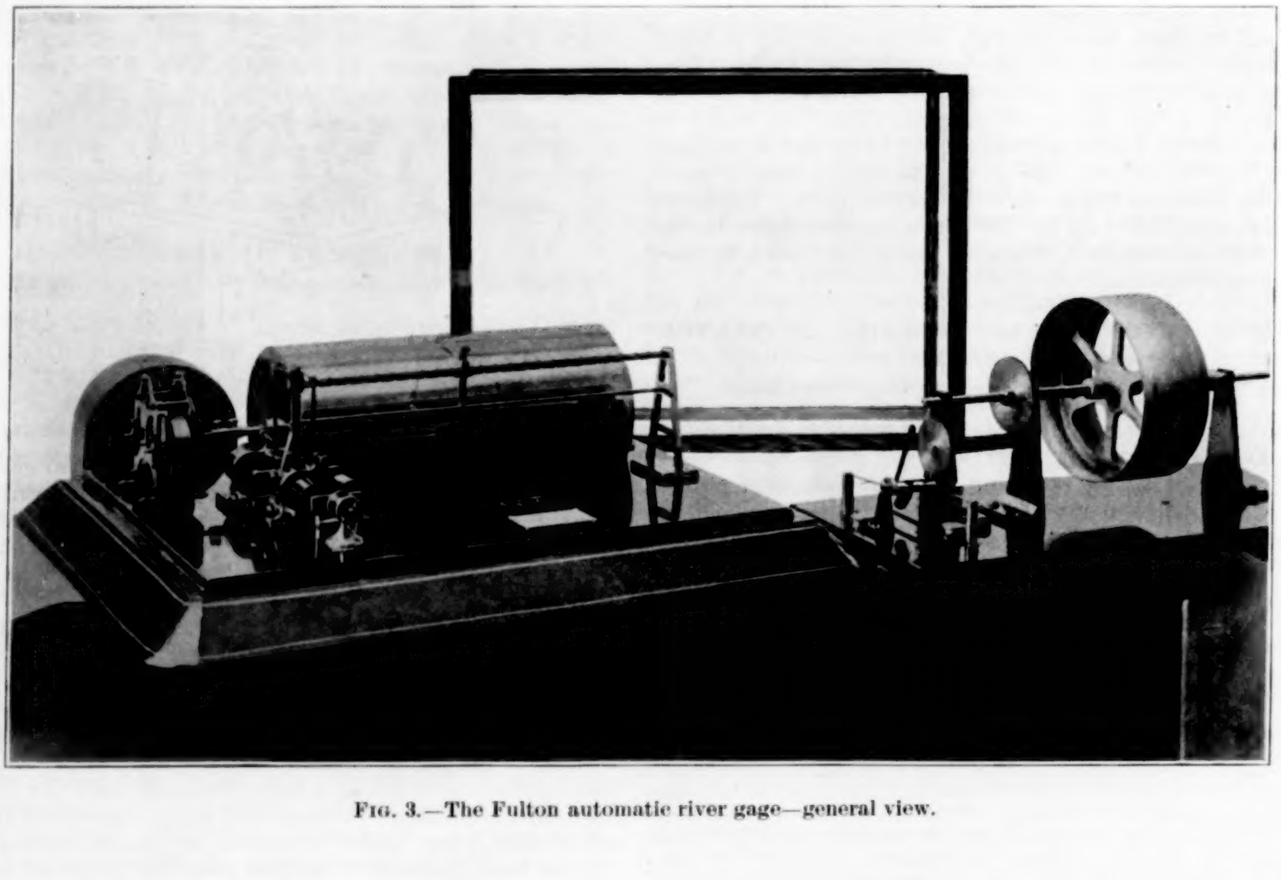


FIG. 3.—The Fulton automatic river gage—general view.

ANTARCTIC RESEARCH.

Abstract from the Monatskarte für den Nordatlantischen Ozean, March, 1903. Communicated by JAMES PAGE, United States Hydrographic Office.

Four independent expeditions are at present engaged in geographical and scientific research in the neighborhood of the Antarctic Continent.

I.—THE GERMAN EXPEDITION.

The steam schooner *Gauss*, 436 tons net, Captain Ruset, Chief of Scientific Staff Professor von Drygalski, sailed from the mouth of the Elbe August 15, 1901, and arrived at St. Vincent September 11. From September 16 to November 23 the vessel was en route from St. Vincent to Cape Town, the voyage being made principally under sail and along the usual route. Leaving Cape Town December 7, Kerguelen was reached January 1, 1902, having touched meanwhile at Possession Island, in the Crozet Group. The *Gauss* sailed from Kerguelen January 31, 1902, her presumable destination being Termination Land, situated to the southeast of Kerguelen, although of this we have no positive assurance. In consequence of her delay of six weeks, the *Gauss* failed to meet the Lloyd steamer *Tauglin* at Kerguelen, as originally planned, but the supplies carried by the *Tauglin* were in all probability received. The latest advices from the *Gauss* and from the four persons left at the supply station in Royal Sound, Kerguelen, were brought by the steamship *Essen*, which reached Australia April 2, 1902. It is hoped that the *Gauss*, in spite of the delay in her departure for the Antarctic regions proper, has yet found sufficient time for a preliminary study of the distribution of land and water, and that she has likewise succeeded in establishing herself in suitable winter quarters, forestalling the necessity of a drift in the ice, such as was the experience of the *Belgica* in 1898–99. As the vessel has probably already succeeded in emerging from the ice, news of the party may be expected within the next two or three months, and in any case not later than the spring of 1904. The *Gauss* is completely equipped for a 2-years' stay in the ice. In case of failure to hear from her by June 1, 1903, a relief expedition is to be despatched. The crew of the supply station in Kerguelen is supposed to have left the island in March, 1903, upon the steamer *Transport*.

II.—THE BRITISH ANTARCTIC EXPEDITION.

The steam schooner *Discovery*, 483 tons net, Scott, Commander and chief of expedition, sailed from England August 6, 1901, reaching Lyttleton November 28. On the voyage outward a latitude of 63° south was attained and certain ice investigations undertaken. The vessel left Port Chalmers, N. Z., December 24, 1901, bound for the vicinity of Cape Adare, east coast of Victoria Land. The departure thus antedated that of the German vessel *Gauss* by a single month. As Victoria Land has been frequently visited, the English expedition has a relatively safe field of operations and a readily available path of retreat. It may be safely surmised that the line of geographical investigation will extend outward toward the east and along the celebrated ice barrier of Ross. No time has been lost in fitting out a relief expedition, the whaler *Morning*, 297 tons net, having left England July 9, 1902, and arrived in Lyttleton November 16. It is presumed that the relief vessel left Lyttleton bound for Victoria Land during December, 1902. Here she will await news of Captain Scott at certain prearranged points. The instructions furnished Captain Colbeck of the *Morning*, with reference to the search for the main expedition, were a masterpiece of clearness and precision. Captain Colbeck has exclusive command of the relief party on the *Morning*, inasmuch as the latter is equipped solely for nautical work. The corresponding demand for freedom and independence of action on the part of the commander of the proposed German relief expedition appears to be well founded, inasmuch as the purely nautical difficulties to be encountered are likely to demand the highest skill.

Both the *Gauss* and the *Discovery* are wooden vessels, newly built and especially designed for the work in hand.

III.—THE SCOTCH EXPEDITION.

The steam whaler *Scotia*, 214 tons net, Captain Robinson, Chief of Expedition W. S. Bruce, left the Clyde November 3, 1902, bound for the Falkland Islands, from which point the high latitudes of the South Atlantic Ocean are to be explored in the direction of the Weddell Sea. The expedition is not equipped for wintering in the ice, the intention being to retire north of the ice limits during that season. The main object in view is marine investigation, a sort of south Polar deep sea expedition. From this point of view, and in consideration of the fact that the region specified has never hither been investigated, and, indeed, has not even been visited since 1823, we are justified in expecting most valuable results. The delay in the departure of the *Scotia* for the ice region, as in the case of the German expedition, is the sole cause for anxiety.

IV.—THE SWEDISH EXPEDITION.

The steam whaler *Antarctic*, 175 tons net, Captain Larsen, Chief of Expedition Dr. O. Nordenskjiold, is at work in approximately the same region as the Scottish expedition, but has the advantage of one years' start. It is a combined land and sea investigation, taking its starting point from the land known to exist south of Cape Horn, the east coast of Graham Land, or King Oscar Land. The *Antarctic* left Sweden October 16, 1901; reached Port Stanley, Falkland Islands, December 31, 1901, and left for the frozen sea January 1, 1902. Ice conditions were everywhere so unfavorable, however, that the vessel was able to penetrate but little beyond the Antarctic circle. Winter quarters and an observation station were established in latitude 64° 30′ south, longitude 57° 10′ west, in Admiralty Sound, at the southern extremity of Louis Philippe Land. Six men, among them Dr. Nordenskjiold, were left at this point with supplies sufficient for two years, while the *Antarctic* returned to the Falkland Islands and sailed thence April 11, 1902, for a hydrographic survey in the South Atlantic Ocean. The party visited South Georgia, remaining there from April 22 to June 15, and also visited the German station established in Cumberland Sound during the year 1882–83. The vessel was to have arrived at the land station occupied by the Chief of Expedition, Dr. Nordenskjiold, about January 1, 1903. News of her is awaited with interest.

The simultaneous presence of these four expeditions in different parts of the south Polar regions can not fail to add materially to our geographical and scientific knowledge, even though their efforts be hampered by unfavorable ice conditions, to which many indications point. The magnetic observations are likely to prove of specific interest.

LATEST.

Since the above was written definite information has been received as to the outcome of the British Antarctic Expedition, the relief ship *Morning* having returned to Lyttleton March 25, 1903. She reports finding the *Discovery* on January 23, 1903, in MacMurdo Bay, Victoria Land. Commander Scott sends the following (see Scottish Geographic Magazine for April, 1903, p. 122):

The *Discovery* entered the ice pack January 23 (1902) in latitude 67° south. Cape Adare was reached January 9 (?). A landing was effected on the 20th in an excellent harbor, situated in latitude 76° 30′ south. The *Discovery* then proceeded along the barrier within a few cables' length, examining the edge and making repeated soundings. In longitude 165° [west ?] the barrier altered its character and trended northward. Soundings here showed that the *Discovery* was in shallow water. From the edge of the barrier high snow slopes rose to an extensive heavily glaciated land, with occasional bare precipitous peaks. The expedition followed the coast line as far as latitude 76° south, longi-

tude 152° 30′ [west ?]. The heavy pack formation of the young ice caused the expedition to seek winter quarters in Victoria Land. The ship was frozen in March 24, 1902. The expedition passed a comfortable winter in well-sheltered quarters. The lowest recorded temperature was 62° F. below zero. Sledging commenced September 2, 1902; parties being sent out in all directions. That under the command of the chief of expedition traveled 94 miles to the south, reaching land in latitude 80° 18′ south, longitude 163° west, establishing a world's record for the farthest point south. The party found that ranges of high mountains continue through Victoria Land. At the meridian of 160° west, foot hills much resembling the Admiralty Range were discovered. The ice barrier is presumably afloat. It continues horizontal and is slowly fed from the land ice. Mountains ten or twelve thousand feet high were seen in latitude 82° south, the coast line continued beyond, at least as far as 83° 20′, nearly due south.

NOTE ON THE BAROMETRIC PRESSURE AT COLON.

By General Henry L. Abbot, dated May 30, 1903.

The data for August, September, and October, 1902, at Colon, referred to in the Monthly Weather Review, March, 1903, p. 143, having been communicated to me in all their details, I am now able to complete the study of the mean barometric pressure at this place at sea level.

Hour.	Millimeter.	Hour.	Millimeter.
1 a. m.	757.99	2 p. m.	757.24
2 a. m.	757.70	3 p. m.	756.76
3 a. m.	757.40	4 p. m.	756.63
4 a. m.	757.34	5 p. m.	756.71
5 a. m.	757.44	6 p. m.	756.91
6 a. m.	757.65	7 p. m.	757.25
7 a. m.	758.02	8 p. m.	757.64
8 a. m.	758.57	9 p. m.	758.05
9 a. m.	758.96	10 p. m.	758.28
10 a. m.	759.06	11 p. m.	758.40
11 a. m.	758.83	Midnight	758.33
Noon	758.41		
1 p. m.	757.74	Mean for the 24 hours.	757.80

First, as to reduction to sea level. Using Guyot's Tables I adopt for Colon (25 feet elevation) a correction of + 0.026 inch. I am informed that "+ 0.02 inch was used for several weeks until + 0.03 was authorized and this is now used." So there is no sensible difference in our methods of reduction. For Alhajuela I adopted (height 43.7 meters or 143 feet) a correction ranging from + 3.74 to 3.78 millimeters according to the corresponding air temperature, say + 0.147 to + 0.149 inch. This, by comparison with the above Weather Bureau figure at Colon, seems to be in good accord. From a note that I wrote at Paris, in 1900, giving, in French units, the full hourly record for eight months in 1898 and 1899 at Colon, I quote the preceding hourly means.

This indicates a correction, to reduce an 8 a. m. reading to the mean for twenty-four hours, of —0.77 millimeter. Referring to each of the eight months I find the differences to be: October, — 0.8; November, — 0.8; December, — 0.8; January, — 0.8; February, — 0.6; March, — 0.8; April, — 0.8; May, — 0.9; mean of the eight months, — 0.79.

Unfortunately October is the only month common to the two series of these Weather Bureau records for 1898 and 1903, but in view of the above uniformity of the value of the reduction from 8 a. m., observations to the mean of the twenty-four hours, I think we may safely adopt a value at Colon of — 0.80 millimeters. Hence, the computation by the Editor on page 143, becomes as given in the following table, in millimeters for sea level:

Year, 1902.		August.	September.	October.
Weather Bureau barometer	Mean, 8 a. m.	757.56	758.18	758.73
	Correction	—0.80	—0.80	—0.80
	Mean, 24 hours	756.76	757.38	757.93
Panama Company's barograph.	Readings	762.51	762.88	763.64
	Corrections	—5.75	—5.50	—5.71

This computation gives a mean correction of —5.65 millimeters for the barograph. By using the Alhajuela horary curve the Editor found the correction to be —6.00, while my comparison with the records on the northern shore of South America gave —3.90 millimeters. These three values for the correction, converted to inches, become: —0.022, —0.024, and —0.015, with a largest discrepancy of 0.0083. I shall adopt —5.65 millimeters as probably the better value, and the small discrepancies obtained by such different methods make me believe it to be quite satisfactory. The mean reading at sea level at Alhajuela is then 757.86 millimeters, or 29.840 inches. The mean reading of the hourly series made by the Weather Bureau at Colon for eight months in 1898–99 was 29.866 inches.

NOTES AND EXTRACTS.

CLIMATIC FACTORS IN RAILROAD ENGINEERING.

A thesis on the above subject has been prepared by R. M. Brown as a part of his course in general climatology at Harvard University and has been published in the Journal of Geography for April, 1903. The struggle of railroads against climatic conditions has been recorded so fully during the past century as to become exceedingly instructive and the influence of the various climatic factors is presented one by one in Mr. Brown's memoir.

As to heavy precipitation he notes that the rainy seasons are often followed by droughts and this alternation destroys all woodwork either by shrinkage and splintering or by the growth of fungi. Railroad ties decay when there is a good supply of moisture and when the temperature is between 32° and 150°. Data on these points are given for India, South Africa, Central Africa, and Central America.

The diseases that are considered peculiar to climate, such as cholera, malarial fevers, and yellow fever offer difficulties that must be overcome. The experiences of numerous large railroad undertakings are mentioned. The droughts that occur in some locations require the building of huge tanks while in other cases one must go a long distance to obtain pure water. Outdoor work can not well be done in the rainy weather and laborers accustomed to hot dry weather lose many days in the rainy season.

The floods and damages by heavy rains are matters of great importance and "are registered on the books of the construction companies with unceasing regularity. * * * The history of every road that traverses the belt of heavy precipitation is a story of continual struggle against floods." In regions of heavy rainfall land slips are frequent and a long list of these is given by the author.

The ballast on the roadbed appropriate to the long, dry season is not appropriate to the heavy-rain season. In general, the ballast produces dust haze sufficient to obscure the approaching train, the dust also penetrates the machinery, causing hot axles and other damage. In America and England under most conditions, stone ballast is the more expensive but in India the climate reverses this rule.

In regions of moderate precipitation whether of rain or snow, the length and weight of the freight trains is determined by the weather; thus, on the Pennsylvania Railroad west of Pittsburg, the load assigned to an engine is 1750 tons in good weather and 1225 in bad weather. On the Union Pacific road the snow offers great obstacles, about 2 per cent of the entire expense of the road is credited to the removal of snow and repairs of snow sheds. The Iquique Railroad of Chili reports increased cost of working during fogs which produce slippery rails.

In regions of light precipitation, or drought, railroad ties

decompose; the danger of fire is increased, the burning bridges cause wrecks of trains. In the Arabian deserts the railroad operators suffer comparatively little from disease. On the Transcaspian road the lack of good water brought about disease. On the Iquique road it is necessary to convey water in tanks and in some cases distilled water was carried 40 miles on mules.

In regions of high altitude the rarefaction of the air causes much trouble to the operators, but on the other hand the absence of germs prevents the decay of organic matter. In the report of work on the railroad up the Jungfrau, Dr. Kronecker stated that mountain sickness sets in at altitudes varying with different persons, but that it attacks all persons as soon as they indulge in the least muscular effort above 10,000 feet. Persons in good health can stand being passively transported up to 12,000 feet without inconvenience; a prolonged sojourn may, however, be disastrous. On the Callao, Lima, and Oroya Railroad many thousands of laborers lost their lives. "So difficult was it to work in the rarefied air at high altitudes that riveters did not average a week's work each and many returned on the next train." On the other hand, in building the Sierra Leone Railroad the number of deaths and invalids was wonderfully low, but the climate had an enervating effect and there were frequent absences on leave. In the upper portions of the railroads, such as the Jungfrau, snow avalanches are a serious obstacle but may be avoided by burrowing under or by underground tunnels. Many railroads are abandoned during the snow season. Not only in Switzerland but also in the Rocky Mountain region snow sometimes overpowers all human efforts.

In regions of severe winter cold another class of obstacles is met with, namely, the formation of ice. Although deep and frozen rivers and lakes may be traversed by railroads, yet when the breakup comes in springtime there is a period when such transportation must cease and when boats also are impossible. The experiences of the Transsiberian road and the Canadian Pacific are given with some detail. The average number of days during which work is possible on account of the snow and ice and the frozen ground is very limited. At Lake Baikal the soil is unworkable from October to April; at Vladivostock, the number of days when the temperature is below freezing is 150, and, in general, on the Transsiberian railroad the total number of working days in a year is about 100. A general tabulation of the number of working days in each month of the year, for various portions of the United States, would perhaps elucidate many of the problems relating to the labor question.

METEOROLOGICAL EXPEDITION TO THE BAHAMAS.

The Geographical Society of Baltimore, which has been organized and developed through the efforts of Dr. George B. Shattuck and of which Dr. Daniel C. Gilman is President, has organized an expedition for a scientific survey of the Bahama Islands. This expedition will sail on Monday, June 1, from Baltimore for Nassau and other points in the Bahamas. There are about twenty-five scientific members of the party. The vessel, *William H. Van Name*, a schooner of 97 tons, 100 feet long, 26 feet wide, and 9 feet draught, has been chartered, with a special crew, under Capt. C. D. Flowers. The general expenses of the expedition, amounting to about $6000, have been defrayed by contributions from the Geographical Society of Baltimore, the Johns Hopkins University, the Coast and Geodetic Survey, and, especially, the Governor of the Bahamas, Sir Gilbert T. Carter, who will accompany the expedition. A great variety of scientific work is provided for, such as the culture of bacteria, the study of mosquitos and malaria, the observation of marine life at great depths through panes of plate glass inserted in the bottom of a dory. A monument will be established as a bench mark, to which the mean sea level can be referred, and any change in the altitude of this monument above mean sea level will indicate the rising and falling of the earth's crust. A self-registering tide gage will be established at Nassau and be maintained for at least a year by the United States Coast and Geodetic Survey. The Department of Agriculture has allowed the following officials to accompany the expedition, namely, Dr. Oliver L. Fassig, Section Director, United States Weather Bureau, in charge of observations on climatology and physics, and Messrs. C. M. Mooney, J. C. Britton, and E. C. Hughes, who will conduct a soil survey. The National Museum will send Mr. Barton Bean, curator of fishes, who will conduct the work in marine zoology. Dr. Fassig carries several kites for special aerial exploration and will also conduct magnetic observations; he will be assisted by Mr. J. E. Routh. Geology, botany, medicine, and other branches of science are represented by the other members of the party.

Such expeditions as these for geographic exploration and scientific observation give an immense stimulus to the progress of science. Every university profits by encouraging such work. The earth, its atmosphere, and its inhabitants can be properly studied only in proportion as we travel and learn to take a comprehensive view of the whole globe.

MISCELLANEOUS ITEMS.

The Sierra Club of San Francisco has organized an excursion to the summit of Mount Whitney. Prof. Alexander G. McAdie, of the United States Weather Bureau; Prof. Gifford Pinchot, of the Bureau of Forestry, and Dr. G. K. Gilbert, of the United States Geological Survey, will accompany it. It is hoped that Professor McAdie will be able to establish maximum and minimum thermometers on the summit, so that a year hence we may have a record of the extremes of temperatures that have occurred there.

Mr. A. F. Osler, the inventor of the self-recording pressure-plate anemometer, established at many stations in England, died on April 26, near Birmingham, England, at the advanced age of 95. He was a Fellow of the Royal Society of London (1855) and one of the founders of the Royal Meteorological Society (1851).

An international kite competition will be held on the Sussex Downs on June 25.

The Berlin Society for the study of the globe (Gesellschaft für Erdkunde) will celebrate its 75th aniversary on May 4. This society has greatly furthered the progress of meteorology.

When Captain Colbeck discovered the position of the *Discovery*, his own vessel, the *Morning*, was eight miles distant, and a floe of ice prevented any nearer approach, Therefore, coal and provisions were transferred by means of sledges. The *Discovery* is only provisioned until January, 1904, so that a second relief expedition will be necessary.

The *Fram*, under the command of Captain Sverdrup, reached Norway on September 12, 1902, after an absence of four and a quarter years, during most of which time she was locked up in the great Arctic ice fields. The most northerly point attained was 81° 40′ north, in latitude 94° west, and Captain Sverdrup thinks it unlikely that land will be discovered in that region. Meteorological observations were taken every second hour during the four years.

The meteorological report of Mr. George Duthie, for the year ending March 31, 1902, states that he has in operation 7 barometric stations, 3 climatological or thermometric stations, and 9 simple rainfall stations. Of the total number 16 are in Mashona Land and 13 in Matabele Land.

In Nature for May 7, 1903, Mr. William J. S. Lockyer compares the rainfall in several regions of the globe with the variations of the sun spots since 1800, hoping thereby to elucidate the occasional diminution of rain and the consequent droughts. He begins by adopting 5-year means instead of the means of single years, and from these he eliminates the minor irregularities by drawing smoothed or free-hand curves. He finds a long period variation in the rainfall, the greatest rainfall occurring in the years 1815, 1845, 1878–1883, while the rainfall is decidedly deficient in the years 1825–1830, 1860, and 1893–1895. Mr. Lockyer finds indications of a connection between the sun spots and the periodicity of rainfall, such that the minima of sun spots in 1843 and 1878 preceded the maxima of rainfall, he therefore ventures to prolong the curve, and virtually predicts a minimum of sun spots and maximum of rainfall in 1914.

In his annual report for the year ending June 30, 1902, Prof. S. P. Langley describes the work done at his astro-physical observatory in Washington, and which relates mostly to the absorption of the solar rays in the earth's atmosphere as well as in the sun's atmosphere. He says:

A presumption exists, almost amounting to certainty, that the total radiation of the sun is variable in some relation to the appearance of sun spots, but nothing is yet known to fix definitely the amount of this supposed variability or to measure its effect upon the earth.

WEATHER BUREAU MEN AS INSTRUCTORS.

The course of instruction in meteorology and climatology offered by the Editor to the students of Columbian University, Washington, D. C., has been taken by only one student during each of the past two years. During the college year 1901–2 Mr. R. S. Bassler (the son of Mr. S. S. Bassler, Local Forecast Official at Cincinnati) pursued a course on meteorological instruments, embracing the Editor's Treatise on Meteorological Apparatus and Methods and some other more recent works. During the college year 1902–3 Mr. Alvin P. Burrows, of the Central Office, pursued the course in climatology, which, however, was not given as a course of lectures, but consisted of a study of a manuscript treatise on The Climates of the Globe, by Prof. Alexander Woeikof of the University at St. Petersburg. This treatise was translated from the Russian for the Editor by Prof. A. Ziwet, of the University of Michigan, revised by the author, and is now again in course of further revision in order to adapt it especially to use by American students.

Prof. F. H. Bigelow's course in the Columbian University, in higher meteorology and solar physics, has been taken by Mr. Herber L. L. Solyom, who received his degree of Master of Science (M. S.) from the Columbian University on the completion of the year's work. This course included the mathematical analysis summarized in Bigelow's Eclipse Meteorology and Allied Problems. The thesis submitted by Mr. Solyom related to the present status of research into solar radiation, the solar constant, the radiation function as applied to the earth's atmosphere, and the effect of pressure and temperature upon the solar spectrum.

Mr. S. S. Bassler, Local Forecast Official, Cincinnati, Ohio, delivered an address on May 10, 1902, before the Teachers' Association in Hamilton County, Ohio, on instruction in meteorology in the primary school. Mr. Bassler conducted a course in meteorology at the summer school of the University of Cincinnati from July 5 to September 13, 1901, consisting of ten lectures, embracing the following subjects:

July 5. Introduction; explanation of instruments, charting temperatures, and drawing isotherms.

July 12. Temperature; chapter 2 of Waldo's Elementary Meteorology, charting pressure, and drawing isobars.

July 19. Pressure and wind; Waldo's Elementary Meteorology, chapters 3 and 4; charting isotherms and isobars together.

July 26. Moisture; Waldo's Meteorology, chapters 5 and 6; preparation of a complete weather map.

August 2. Written examination and review.

August 16. primary circulation of the atmosphere (Waldo, chapter 8).

August 23. Secondary circulation of the atmosphere (Waldo, chapter 9).

August 30. Miscellaneous phenomena (Waldo, chapter 10).

September 6. The weather and the weather map (Waldo, chapter 11).

September 13. General review of the whole subject, with lantern slides.

During the subsequent school year, 1902–3, Mr. Bassler sent to every school in Cincinnati the daily weather map and special notices of all weather changes for the benefit of the scholars and their families. Fifty-six schools and colleges and 60,000 pupils entered into this arrangement.

Mr. J. W. Bauer, Section Director, Columbia, S. C., reports that on November 12 he lectured to the public school pupils and patrons at Laurens, S. C., on the history and the work of the Weather Bureau.

Mr. E. A. Beals, Forecast Official, Portland, Oreg., reports the visit of the high school class in physical geography to the office of the Weather Bureau on October, 16, 1902.

Mr. A. H. Bell, Observer, Eureka, Cal., reports a lecture on April 20, 1903, before the Eureka Club, on the uses of meteorology; very great interest was shown in the subject and a movement was made toward a permanent meteorological outfit for educational purposes.

Mr. W. T. Blythe, Section Director, Indianapolis, Ind., reports a lecture on forecasting before the junior class of the Indiana Medical College. The Secretary of the Horticultural and Agricultural Society of Richmond, Ind., Mr. Walter S. Ratliff, advocated the importance of a series of talks of a practical nature, on the relations of the Weather Bureau to the pursuits of man. Commenting on this, Mr. Blythe said:

There is no longer any doubt in my mind but that the leaders in educational institutions, whether they be in universities, colleges, or farmers' institutes, who persistently decline to avail themselves of and disseminate the meteorological and climatological knowledge gained by the Weather Bureau during the last third of a century, are doing less than their duty to the public.

Mr. Blythe reports that a model Weather Bureau outfit has been established at the Manual Training High School in Indianapolis, and the class of twenty pupils in physiography, under Mr. M. H. Stuart will keep a weather record and study meteorology. It is not the purpose of the course to develop weather prophets but to show the students that the work of the Weather Bureau is a consistent course of reasoning based on scientific principles and not simply guesswork. Mr. Stuart's instruction is broad and excellent.

Mr. Edward H. Bowie, Section Director, Galveston, Tex., reports attending the Farmers' Institute and other agricultural organizations at Austin, Tex., February 12 and 13, 1903.

These lectures were published in full in the Proceedings of the Congress of the State Farmers' Institutes and afforded Mr. Bowie occasion to meet a large number of State officials and prominent agriculturists, and contributed greatly to the intelligent appreciation of the work of the Weather Bureau in that State. Among other things, Mr. Bowie said:

The Weather Bureau maintains nine regular stations within the State of Texas; we telegraph to forty-one distributing centers the daily fore-

casts and warnings of cold waves, frosts, snows, high winds, etc., and then these forecasts are duplicated to the postmasters of approximately nine hundred post offices in the State to be distributed through the Rural Free Delivery Service; in case of severe weather changes every point in the State having telegraphic facility is advised of the impending severe weather; these are disseminated in accordance with arrangements that have already been outlined; the stockmen of the western and northwestern portions of your State are advised of the approach of the dreaded "norther" that they may care for the stock; the farmers of the river bottoms are warned of the approach of disastrous floods, as for example the floods of the Brazos in 1902; the sugar planters are kept advised when a severe freeze threatens the destruction of their cane crops and they are enabled to cut and windrow the cane and thus bid defiance to the elements; the truckers and fruit raisers are warned of weather changes injurious to their interests else they can not grow these crops with profit; the transportation companies make use of the weather forecasts and warnings to protect the shipments in their charge, and are thus enabled to give lower rates for transportation; the cotton grower, the sugar planter, and the rice grower are presented through the medium of the press and daily bulletins with information that will keep them, and others interested, in touch with the weather conditions prevailing from time to time and the progress of the growing crops; * * * the statistics that are gathered from this Bureau from one hundred voluntary observers throughout the State are of inestimable value in determining crop conditions, and allow me to state that the statistics gathered from this source during the past four months prove conclusively that not within the past score of years has the soil and subsoil of the farms of Texas been in better condition to receive the seed during the coming springtime and to carry the winter grain to a time of bountiful harvest.

Mr. F. H. Brandenburg, Forecast Official, Denver, Colo., addressed the school teachers of Denver on April 5, 1902:

The growth of the Weather Bureau was traced from the organization of the service to the present time; the excellent system for the collection and dissemination of weather, crop, and climatological information was outlined, and the value of the forecasts, warnings, etc., described.

The lecture closed with a full explanation of the weather map, copies of which were in the hands of those present.

Mr. Allen Buell, Observer, San Antonio, Tex., reports being visited in succession by all the classes in the schools in that town that have received instruction regarding the use and operation of the instruments, the construction of weather maps, and the method of weather forecasting.

Mr. William G. Burns, Section Director, Phoenix, Ariz., delivered a lecture before the American Climatological Association at its meeting at that place on June 3, 1902. His address has been published in pamphlet form. It gives a comparison between climates of different places in Arizona. Among other things, he touched—

briefly on the effect of irrigation in increasing the humidity of the atmosphere in this locality. A drop of ink let fall into a hogshead of water is certainly there, but it would take a careful chemical analysis to make a determination. The water vapor evaporated from the irrigated fields adds to the humidity of the atmosphere, but when the small area under irrigation is compared with the adjacent desert region and the great capacity of surrounding space for water vapor is taken into account we conclude that it has a salubrious rather than a deleterious effect. During crop-growing seasons, when the water is spread over the greatest possible area, relative humidity as low as 3 per cent has been measured.

Months.	Mean of dry bulb.		Mean of wet bulb.		Mean relative humidity.
	8 a. m.	8 p. m.	8 a. m.	8 p. m.	
1901.	°F.	°F.	°F.	°F.	%
January	43	62	38	48	47
February	46	65	43	51	59
March	48	71	40	51	38
April	51	78	41	54	29
May	61	87	49	60	30
June	68	97	50	62	19
July	80	104	65	71	33
August	79	100	68	72	43
September	68	95	54	64	28
October	60	83	50	60	39
November	51	72	46	55	49
December	40	62	32	45	32
Annual	58	81	48	58	37

In a table of climatological data for Phoenix, Ariz., for the year 1901, Mr. Burns gives the mean of the wet-bulb thermometer at 8 a. m. and 8 p. m., seventy-fifth meridian time, and as such data are not generally given, although of considerable interest, we append the preceding table, copied from the appendix to his address:

Mr. Ford A. Carpenter, Observer, San Diego, Cal., lectured several times before the senior class of the State Normal School during May, 1902. His lectures included not merely a description of instruments, but also numerous points of interest in connection with local forecasting, some of which we quote from the San Diego Union, as follows:

Preceding rain the barometer fluctuates rapidly, rising and falling a few hundredths of an inch during the general fall. The actual height of the barometer does not matter, often the heaviest rain begins after the barometer has started on the upward curve. Clearing weather and a rising barometer often occur together. A rapid rise in the barometer often presages decidedly cooler weather at San Diego. The humidity often decreases for a few hours before a rain. In fact a drop of from 10 to 15 per cent below the normal of 70 per cent of relative humidity generally precedes rain by from six to twelve hours. Conditions may be ever so threatening in other respects, but if the humidity is above 70 per cent, precipitation is extremely doubtful, except in the form of fog or mist. Humidity observations are often the only way of distinguishing between a rain-bearing cloud and high fog. A cloud below the top of San Miguel is simply lifted fog, whereas a cloud capping the mountain is always a threatening condition. In the spring the rain winds precede the rain by from twelve to twenty-four hours, but in the fall and winter, the south or southeast wind may blow steadily for thirty-six or forty-eight hours before rain falls, and when such a rain does commence a generous precipitation occurs. Rain winds must always be brisk, with a steadily increasing velocity; fair weather winds are light and shifting, except only the northwest trade winds of summer, which may reach twenty-five miles per hour. In this locality cirro-cumulus clouds, having well-defined darkened convexities, nearly always bring rain. The first appearance of the cirro-cumulus is generally followed by rain within twelve hours. In the beginning of the rainy season the sky will be made beautiful by these delicately rounded masses for two or three days before the rain sets in. A thick sheet of cirro-stratus cloud will sometimes herald a general rain. During the rainy season a very small cloud, like a streamer of a dark shade, is generally entwined about a threatening cumulus cloud and always precedes rain. These clouds strongly resemble closely twisted flax, and apparently indicate a condition of complete local saturation; they have no direction of their own, but depend upon the movement of the parent cloud.

Another cloud condition, from which positive information may be obtained, is the saw-tooth edges of cumulus clouds. Other conditions may be ever so threatening, but if the clouds have this wave-like appearance, with their crests inclined to the south, no rain will fall. These clouds are frequently seen on the western horizon, and clearly indicate the direction of the upper air currents. The directions of these upper projections, whether they point north or south, indicate respectively fair weather or rain.

On March 9, 1903, Dr. Isaac M. Cline, Forecast Official, New Orleans, La., before a large audience, delivered a lecture in Alumni Hall as one in the course of the Jesuits' alumni series, giving especial attention to weather forecasting for the Gulf States. At the conclusion, he said:

If the predictions of those who pretend to make long range forecasts are examined, it is found that they bunch three to five days together and style that a storm period and claim that stormy conditions will occur on one of those dates. Now, we have already noticed that the number of disturbances styled storms or low pressure areas, which cross the United States from west to east, average one in every three days. In fact, there is never a day but that the weather chart shows a storm in some part of the United States. Bear in mind that the so-called long range weather forecaster always says the disturbance will occur about a certain date, either within two days before or within two days after. This gives five days within which the disturbance may occur. Now let us take New Orleans for example. Select any five days and you will find that within those we have nearly every kind of weather which occurs at the season of the year in which the five days are selected. In fact there are hardly three successive days without the passage of a disturbance. Such forecasts are indefinite as to the date and character of the weather which may be expected. You never hear of any lives or property being saved by the so-called long range forecasts. Interests affected by severe weather conditions never look at such warnings. The captains of vessels, sugar planters, orange growers, truck farmers, and shippers look constantly to the United States Weather Bureau for warnings. The Weather Bureau forecaster must specify the weather which will prevail during each twelve-hour period for every locality in his district. These warnings are always issued twenty-four and thirty-six sometimes forty-eight and seventy-two hours in advance. Warnings of the severe freeze

of December 14 to 18, 1901, were issued by the Weather Bureau forty-eight hours in advance. Each locality was advised forty-eight hours in advance just what temperature to expect. Sugar planters in Louisiana and Texas, who had interested themselves in the Weather Bureau warnings, windrowed all the cane they possibly could. One plantation windrowed nearly 2000 acres of cane, and others in proportion to amount standing. A careful estimate of the value of the cane saved as a result of this one warning, is one million of dollars, for cane that was not windrowed was lost. The Sugar Planters Journal, December 20, 1902, in commenting on these warnings, and the confidence of the sugar planters, says:

"This faith in the prognostications of the weather man was largely brought about by the accurate forecast of the destructive freeze of last December (1891), when the loss to the sugar industry of Louisiana figured, perhaps, upwards of several millions of dollars. Had more planters windrowed promptly upon receiving warning last year (1901) from the Weather Bureau the loss would have been greatly curtailed."

With the United States Weather Bureau such warnings as that above referred to are the rule and such large savings of property are continually taking place throughout the United States. Notwithstanding that the Weather Bureau forecasters have attained a high percentage of accuracy every effort is being made to improve the forecasts. All the changes which we experience at the earth's surface are influenced by conditions in the upper atmosphere. We want records at 1000, 2000, 3000 feet, etc., above the earth, of the changes taking place. These will be obtained by means of kites and balloons and on mountain peaks.

Mr. N. M. Cunningham, Observer, reports explaining the instruments and work of the Weather Bureau to the class in physics of the high school at Valentine, Nebr. He will give a discourse on meteorology before the Teachers' Institute of that place.

Mr. Norman B. Conger, Inspector, United States Weather Bureau, read a paper before the Section of Geology and Geography, Michigan Academy of Science, March 27, 1902, at Ann Arbor, embracing his own personal observations on the Water Temperature of the Great Lakes, more especially of Lake Superior. Mr. Conger also lectured on the afternoon of March 13, 1903, at the Normal School, Washington, D. C., on the wind movement and deductions from the daily weather maps.

Mr. E. A. Evans, Section Director, Richmond, Va., reports finishing his course of lectures on meteorology to the students of the Medical College of Virginia. The course occupied four months and consisted of one hour per week. Students of the junior class were required to attend, but it was optional with the senior class. The course paid especial attention to the relations of weather and disease and a series of diagrams were constructed embodying studies on pneumonia, bronchitis, croup, and influenza. The quiz was adopted as a means of reinforcing instruction. The junior class numbered 48 students. The general character of the course was suggested by Dr. Phillips and the charts were based upon data published in his Climate and Health.

Mr. R. H. Dean, Observer, La Crosse, Wis., reports a lecture on meteorology to the students of King's College.

Mr. H. B. Egbert, Voluntary Observer and Professor of Mathematics and Astronomy at Buchtel College, Akron, Ohio, under date of January 28, 1903, states that in his class work he uses the daily weather maps received from Cleveland, Ohio, and makes his students practise the art of making individual forecasts. During the first part of the term the morning maps are used, but during the latter part the evening data are received and manuscript charts are compiled; isobars and isotherms are drawn and forecast studies are based thereon. This course has continued for three years, and is considered to be a very profitable feature of their scientific education. A simple nephoscope has been constructed for the use of one student who has made a study of clouds the subject of her graduating thesis. It is to be hoped that fuller details of this work may be communicated to the Monthly Weather Review.

Dr. O. L. Fassig, Section Director, Baltimore, Md., by special invitation delivered an illustrated lecture on Ancient and Modern Methods of Weather Forecasting on February 20, 1903, before the Franklin Institute of Philadelphia, an institution that has been made famous in the annals of meteorology by the labors of Benjamin Franklin, James P. Espy, A. D. Bache, Joseph Henry, and other distinguished men.

Mr. Robert Q. Grant, Observer, Lexington, Ky., delivered a series of lectures on weather forecasting and meteorology before the senior class of the Kentucky State College during the spring of 1902.

Mr. A. E. Hackett, arranged to give a course in climatology in the Medical Department of the University of Missouri, during the second semester of the scholastic year 1902-3. The course is required for the degree of doctor of medicine, and is confined to a study of the climatic features of the United States with reference to their influence upon health and disease, special attention being given to the comparative hygienic values of the climates of those sections that are frequented as health resorts.

Mr. Enoch G. Johnson, in charge of the weather station in the United States House of Representatives, Washington, D. C., reports as follows:

A feature of the work which has grown during the session is the talks given to excursion parties largely made up of schools and school teachers, upon the work, purpose, and achievements of the Weather Bureau. In many instances notes were taken by the visitors for use in school work upon their return home. As the Capitol is the point of special interest to all visitors, and as excursion parties are more numerous than formerly, this seems to me to be one of the best means of giving out Weather Bureau information to a worthy and intelligent portion of the public. As the maximum of excursion parties occurs during the Christmas holidays and again during Easter week, I think the Capitol a good place in which to disseminate information relating to the Weather Bureau and its work. The talks mentioned above were generally supplemented by furnishing copies of Explanation of the Weather Map and History of the Weather Bureau, with an occasional record sheet from the triple register or rain gage and such literature pertaining to the Bureau as was available at the time.

Prof. A. G. McAdie delivered a lecture upon fog phenomena at the Teachers' Institute, Redwood City, Cal., on April 29. He also took part in the discussions on climatology on April 23 at the thirty-third annual meeting of the Medical Association of the State.

Mr. E. W. McGann, Section Director, New Brunswick, N. J., addressed the pupils of the High School at Pemberton, N. J., on March 19, 1902, on How Forecasts are made and Disseminated by the United States Weather Bureau. Mr. McGann also addressed the Farmers' Institute at Sommerville, N. J., December 5, 1902, on the Weather Bureau and the Weather Forecasts.

Mr. J. B. Marbury, Section Director, Atlanta, Ga., lectured before the Young Men's Christian Association of that city March 22, 1902, on The Weather Bureau and Its Relations to the Public. He also reports a course of lectures on the work of the Weather Bureau, delivered to the Boys' High School in November, 1902.

Mr. A. J. Mitchell, Section Director, Jacksonville, Fla., delivered an address on Uncle Sam and His Weather, on Farmers' Institute Day, at the winter assembly of the Chatauqua of the Tropics, Melbourne, Fla., March 7, 1902.

Mr. L. H. Murdoch, Section Director, Salt Lake City, Utah, addressed the Engineering Society of the University of Utah on March 24, 1902, on the Weather Bureau and its Work, having especial reference to the daily weather map. Mr. Murdoch reports much interest in meteorology in the normal school connected with the university. The pupils are taught to read the barometer, rain gage, and thermometer. The temperature readings are plotted daily for a period of several months, and the resulting curves show quite clearly the seasonal temperature changes. The different cloud forms are studied and the pupils make daily forecasts from the map of the Weather Bureau.

Mr. W. S. Palmer, Section Director, Cheyenne, Wyo., reports an instructive paper on the United States Weather Bureau, read before the Young Men's Literary Club of Cheyenne on November 21, 1902.

Mr. Henry R. Patrick, Observer, Weather Bureau, Marquette, Mich., reports a talk on January 22, 1903, to a large

class of pupils from the Ely Grammar School on the Marquette Weather Station and How Storms are Charted. A similar address was given on February 12 to the class in geography and physics of the Northern State Normal School. Mr. Patrick also reports a lecture before the pupils of the Froebel School on February 26.

Mr. H. W. Richardson, Forecast Official, Duluth, Minn., addressed the pupils of the Blaine High School, West Superior, Wis., on April 23, 1902, his subject being The Weather Bureau. This was followed by an address before the physiography class at the same school on The Circulation of the Atmosphere. Mr. Richardson also reports an address on Instruments, Weather Maps, and Forecasts on the afternoon of February 14, 1903, before the students in physiography of the West Superior State Normal School when assembled in the Weather Bureau office. Mr. Richardson delivered a series of lectures on the subject of meteorology to the Superior State Normal School, closing the course in April, 1903. Letters have been received from J. A. Merrill, vice-president of this school, highly commendatory of these lectures, which indeed seem to have aroused much local interest in the subject. He states that "The charts and data published in the Monthly Weather Review are in constant use in our classes," and he wishes to get similar data concerning Europe, Africa, and South America.

Mr. James H. Scarr, Observer, Sacramento, Cal., as reported in the Union of that city, delivered an interesting lecture on January 30, 1903, on the Work of the Weather Bureau, from which we quote the following paragraph:

> The most popular weather belief in some parts of the country is that the weather conditions are undergoing radical changes. In this particular the modern meteorologist is an iconoclast, ruthlessly smashing the idols of the past and the present with his long and carefully kept records of actual conditions. That there are cycles in weather conditions is a theory, but the recorded observations of the past century fail to reveal anything corroborative. The planting of trees, the practise of irrigation and the cultivation of the soil, especially in the great semiarid plains east of the Rocky Mountains were once believed to have an influence on the climate, but both former and later experience show the probability that the conditions that have rendered these plains semiarid and treeless still prevail uninfluenced by the puny operations of man.

Mr. W. A. Shaw, Observer, Northfield, Vt., delivered a course of two hours per week in meteorology to the senior class, Norwich University, during the winter term of eleven weeks, 1902–3. Waldo's Elementary Meteorology was used as a textbook, with lectures on special subjects not fully treated therein. Special attention was given to weather reports and forecasts and studies of daily maps and climatological charts. For the past seven years the senior class has been required to take this course and pass examinations on the same. Nineteen men took the course during the term 1902–3.

Mr. J. Warren Smith, Section Director, Columbus Ohio, reports attending the Farmers' Institute at Morristown, Bellemont County, Ohio, on February 11 and 13, 1903. The following outline of lectures delivered during the college years of 1901–2 and 1902–3 by Mr. Smith, at the Ohio State University, is submitted by him and may be of assistance to those delivering similar courses at other universities:

OUTLINE OF LECTURES ON METEOROLOGY GIVEN AT THE OHIO STATE UNIVERSITY.

Lecture No. 1.—Introduction.
- Object of course and possible value of study of subject.
- Daily journal of the weather to be kept.
- Question box for correlating cause and effect.
- Phenological studies and notes.
  - Importance and need; progressive work in Canada.
- Historical sketch:
  - Early instrumental records:
    - Florence, Italy, 1643.
    - Charleston, S. C., 1738.
    - Cambridge, Mass., 1743 to 1776.
    - Other New England records in eighteenth century.
    - New Bedford, Mass., 1812 to date, by two observers.
    - Smithsonian, 1852.
    - Signal Service, 1870.
    - United States Weather Bureau, 1891.
- Present system:
  - Stations; men; instruments; observations and elements; telegraph system; code; necessity for accuracy; map making.
  - Maps discussed; maps as supplement to text book.

Lecture No. 2.—The atmosphere.
- Evolution, composition, and office.
- Relation to geological and geographical processes.
- Weight; pressure.
- Impurities; molds; bacteria; Aitken's dust counter; Krakatoa.
- Elasticity of air; height of atmosphere.
- Meteorological elements.
- Instrumental observations.
- Physical meteorology.
- Climatical meteorology.
- Applied meteorology.
- Weather versus climate.

Lecture No. 3.—Temperature.
- Molecular theory of heat.
- Diffusion of heat.
- Solar radiation.
- Astronomical relations; seasons.
- Distribution of heat on surface of earth.
- Effect on land and water.
- Atmospheric transmission, absorption, and radiation.

Lecture No. 4.—Thermometry.
- History of thermometers:
- Description and explanation; corrections.
- Self-recording thermometers.
- Exposure; instrument shelters.
- Isothermal lines and surfaces.
- Temperature gradients; horizontal, vertical.
- Adiabatic changes.
- Daily, monthly, and annual mean temperature.
- Temperature affected by latitude, elevation, topography, and wind direction.
- Temperature ranges and extremes.
- Normal temperatures.

Lecture No. 5.—Illustrated review.
- Slides showing stations, mountain observatories, thermometers, instrument shelters, kites, sounding balloon records, temperature charts, etc.

Lecture No. 6.—Pressure.
- Weight and pressure of air:
- Variation with altitude.
- Thickness of atmosphere.
- Laws of gases:
- Effect of change in temperature upon density.
- Arrangement of air under gravity.
- Physiological effects of abnormal pressure changes.

Lecture No. 7.—Barometry.
- History of barometers; description; corrections; records; reductions.
- Fluctuations:
  - Diurnal; annual; irregular.
- Isobaric lines and surfaces; gradients.
- Geographical distribution of pressure; causes.
- Correlation of wind and pressure.
- Correlation of temperature and pressure.

Lecture No. 8.—Winds.
- Anemometers; anemoscopes.
- Annual and diurnal march of velocity.
- Variations with altitude.
- Diurnal and annual changes in direction.
- Cyclonic and anticyclonic influences.
- Temperature; gravity theory of winds.
- Monsoons; land and sea breezes; mountain and valley breezes.
- Correlations with temperature and pressure.

Lecture No. 9.—Moisture.
- Water vapor.
- Evaporation; humidity; hygrometry; condensation; dew point.
- Clouds; classes and theory of formation.
- Fog:
  - Condensation upon dust; Aitken's dust counter.
  - Condensation upon electric ions.

Lecture No. 10.—Precipitation.
- Description of rain gages.
- Rainfall; causes:
  - Influences of wind direction and topography.
  - Geographic distribution.
  - Hail; snow; dew; frosts; conditions favorable for formation of frost; methods of protection.
- Excessive rainfalls; droughts.
- Retardation of adiabatic cooling by latent heat of condensation.
- Influence upon forests.

Lecture No. 11.—Optical Meteorology.
Reflection; refraction; dispersion; diffraction; absorption.
Transparency of air.
Mirage; halos; parhelia; Krakatoa; rainbows; coronæ.
Atmospheric electricity; lightning; lightning rods; aurora.
Sunspots; St. Elmo's fire.

In connection with this lecture I give an illustrated review, showing slides upon the following subjects:
Barometer; rain gage; sunshine recorder; anemometer; anemoscope; clouds; halos; fog; barometer charts, etc.

Lecture No. 12.—General circulation of atmosphere.
Explanation; causes; difference in temperature; rotation of earth; explanation of low pressure at poles and tropical high pressure belt; relation of pressure and air movements; vertical currents; surface currents; trade winds; monsoons; calm belts or areas; the typical local circulation over the United States.

Lecture No. 13.—Secondary air circulation.
Cyclones and anticyclones:
Description; classes; distribution of pressure, temperature, wind, and weather in cyclones and anticyclones.
Effect of earth's rotation.
Laws of storms; tropical cyclone; extratropical cyclones; hurricanes.
The theory of cyclones and anticyclones:
Ideal systems; condensation theory; tangling or eddy theory; wave theory.

Lecture No. 14.—Local winds, tornadoes, etc.
Thunderstorms: Classes; cause; time of day; relation to cyclones; movement; mountain thunderstorms; thunder squall; derecho; hail; lightning; theory of formation; tornadoes and spouts; air circulation; how formed; movement; vortex; funnel cloud; waterspouts.

Lecture No. 15.—Illustrated review.
Cyclones and anticyclones and their movement.
Pressure, temperature and wind charts for the globe and correlations.
Ocean currents.
Thunderstorms; ideal air circulation; lightning flashes.
Tornadoes; relation to cyclonic areas; damage.

Lecture No. 16.—Weather.
Elements; weather of different zones; in United States; summer and winter; cyclonic and anticyclonic control.
Local signs and prognostications.
Weather predictions; how distributed.

Lecture No. 17.—Climate.
Weather versus climate.
Most important factors in climate.
Continental; oceanic; of different zones; of different continents.

Lecture No. 18.—Climate of United States.
Main types; pressure; wind; temperatures.

Lecture No. 19.—Climate of United States.
Rainfall; snowfall; humidity; clouds; sunshine.
Climate of Ohio; temperature; wind; rain; snow.

Lecture No. 20.—Examination.

In the above course Waldo's Elementary Meteorology was used as the text-book. If I were giving 40 lectures instead of 20, I should use Davis' Elementary Meteorology.

The daily weather maps are consulted at each session, the principles of weather forecasting explained, and the different weather conditions correlated with the conditions shown on the maps. Instruction is also given in drawing isobars, isotherms, and in shading precipitation areas, part of an occasional hour being given up to this. At least one lecture is given at the local Weather Bureau office, where the instruments and all the work of the office is explained. The daily journals of the students are examined and criticised several times.

Mr. Charles Stewart, Observer, Spokane Wash., addressed the pupils of the Spokane High School on March 21, 1902, on Weather Changes and their Causes. The physical geography class of this school visited the Weather Bureau office at Spokane on April 21 and 22. The station instruments and some phases of Weather Bureau work were explained by Mr. Stewart.

Mr. A. H. Sullivan, Observer in charge, Grand Junction, Colo., reports that a class of young ladies and gentlemen from the High School visited the Weather Bureau office and received a lecture on meteorology from the observer in charge.

Mr. L. M. Tarr, Observer, New Haven, Conn., delivered a course of sixteen lectures to a class of thirteen at Yale University, during the college year, 1901–2. The following subjects were considered: A short history of meteorology; the height, composition, pressure, temperature, and moisture of the atmosphere; evaporation, condensation, and precipitation; general circulation of the atmosphere; development and movement of storms; electrical and optical phenomena; description of instruments; laboratory work at the Weather Bureau office.

Mr. Tarr has been appointed lecturer in meteorology at Yale University, and in return the privileges of the University have been extended to him. His course has been enlarged and will hereafter consist of two hours per week during the second half of the college year.

Mr. N. R. Taylor, Observer, Tampa, Fla., reports a lecture given on May 8, by request of the faculty of Mallicoat, Tampa Preparatory School.

Mr. John R. Weeks, Observer, Macon, Ga., reports that the faculty of Mercer University in that city is considering the advisability of adding meteorology and advanced physical geography to its curriculum. By permission of the Chief of Bureau, it is probable that Mr. Weeks will have charge of instruction in these branches and the time required in attendance at the University will be about two hours per week. It is gratifying to note this evidence of the increased interest being taken in this subject in this part of Georgia. Mr. Weeks also reports an informal address on The Relations of the Weather and the Weather Bureau to the Fruit Industry, delivered at the meetings of the Georgia Fruit Growers Association, March 5 and 14, 1902, and March 25, 1903.

Mr. W. M. Wilson, Section Director, Milwaukee, Wis., reports an address delivered by him at Oconomowoc, March 18 and 20, 1902, before the Wisconsin Farmers' Institute, which has been published in the Bulletin No. 16 of that institute, and from which we take the following extract:

Previous to 1870 few people in the United States conceded the possibility of foreseeing the weather, even twenty-four hours in advance, with any greater certainty than that attained by the wisdom of the "oldest inhabitant," but during that year the public was awakened to the fact that the United States Government had established a department for this very purpose, and began dimly to comprehend that it was not only possible to predict the weather with a certain degree of accuracy, but that it could be done with very great benefit to the commercial and agricultural interests of the country. Since that time familiarity with daily accounts of the verification of the prediction of storms, cold waves, etc., has resulted in the public thought far outstripping the actual advance of the science in this respect, and the country now demands a forecast for a season or a year in advance, where it once considered it a wonderful achievement to predict the weather for twenty-four hours.

In pressing this demand it is said that after thirty years of observation and experience the Weather Bureau should be able to furnish a fairly accurate forecast for more than one or two days, and in truth it should, but let me say that we have not been negligent nor indifferent to this demand. We have attacked this problem of long-range forecasts from every conceivable standpoint, vigorously, and at short range. We have carried our instruments to the highest mountain peaks on the continent; we have taken our lives in our hands and explored the upper atmosphere by means of balloons; we have placed meteorographs in kites and sent them up to the distance of a mile in the hope of finding something in the upper strata that would lead to a solution of the problem; we have studied the influence of the moon and the planets and experimented with electricity and magnetism, but thus far we have found nothing to lead us to believe that there is a possibility at the present time of making even a useful, not to say accurate, forecast of the weather for a period much above forty-eight hours. I am aware that there are men in this country * * * who claim to be able to make accurate predictions of the weather for a year in advance of their fulfilment, but so far as we are able to learn, their theories, which are usually based upon the very questionable influence of planetary and stellar bodies have not commended themselves to a single reputable scientist. In this connection I am constrained to say that a foreknowledge of the weather for a month or a year in advance is not in the possession of any living man at the present time.

[The difficulties will undoubtedly be overcome eventually. We need not be discouraged by our slow progress, and we need not have recourse to false methods. Man is here to conquer nature. The attempt to do so strengthens and develops him. Every year witnesses some new conquest, and there is as yet no sign of our having reached our limit.—*C. A.*]

MISS ALICIA DE RIEMER.

The announcement of the sudden death, on April 8, at Milwaukee, of Miss Alicia De Riemer came as a great shock to

the Editor and all of her friends. A few weeks before, she had been enjoying perfect health and pushing forward her course of instruction in physical geography and meteorology at the State Normal School, Stevens Point, Wis.

Miss De Riemer was born in 1873, in India, of American parents, who were then educational missionaries in Ceylon, but who now reside in Washington, D. C. She had for many years devoted herself to school work, and especially to teaching meteorology, climatology, and physical geography by most original and admirable methods. During the summer of 1898 she devoted herself to work at the Weather Bureau in special lines of investigation, and, among other things, compiled the article on "The average frequency of days of hail during the years 1893–1897," published in the MONTHLY WEATHER REVIEW for December, 1898. She also prepared a popular Primer of Meteorology for the use of such schools as follow modern methods of nature study. This work has, we understand, been published for the use of teachers in Wisconsin. An impressive memorial service was held in Washington, D. C., where she is buried, and one, also, at Stevens Point, Wis. In her death meteorology has lost a most enthusiastic student and teacher.—*C. A.*

CORRIGENDA.

MONTHLY WEATHER REVIEW, February, 1903, page 78, column 1, line 14, for "36" read "38." Page 80, column 2, description of fig. 26, for "mile" read "meter" in both cases. Page 81, fig. 27, column 1, transpose the text but *not* the numbers belonging to figs. I and II. Also, for "in cyclones and the" read "in cyclones and in the."

March, 1903, page 135, in table of mean temperatures, W. R. Castle, omit 78.0° and 55.0°, as these are the absolute extremes, not the mean values.

THE WEATHER OF THE MONTH.

By W. B. STOCKMAN, Forecast Official, in charge of Division of Meteorological Records.

CHARACTERISTICS OF THE WEATHER FOR APRIL.

The temperature was above the normal 1.5° to 2.0° in New England, the Middle Atlantic States, Lake region, and North Dakota, and 0.6° above in the upper Mississippi and Missouri valleys; elsewhere it was below normal, the greatest minus departures occurring in the Florida Peninsula, Gulf States, the middle and northern Plateau, and the north Pacific districts.

The precipitation was slightly above the normal in New England, the upper Lake region, upper Mississippi Valley, and the southern and middle Plateau and south Pacific districts, and considerably above in the lower Lake region; elsewhere it was below the normal, the most marked departures occurring in the Florida Peninsula, Gulf States and the north and middle Pacific districts.

The relative humidity was normal in the Middle Atlantic States, upper Mississippi Valley, the southern slope, and north Pacific district. It was slightly below the normal in New England, the Florida Peninsula, South Atlantic and west Gulf States, upper Lake region, North Dakota, the Missouri Valley, and middle Pacific district; in the remaining districts it was above the normal.

The cloudiness was normal in the south Pacific district; above the normal in the Middle and South Atlantic States, Ohio Valley and Tennessee, upper Lake region, upper Mississippi Valley, the southern slope, southern Plateau, and north Pacific district; elsewhere it was below the average.

PRESSURE.

The distribution of mean atmospheric pressure is graphically shown on Chart IV and the average values and departures from normal are shown in Tables I and VI.

The pressure was highest along the Pacific coast, with secondary high areas of somewhat lower pressure over the Lake Superior region, and along the middle and east Gulf coast.s It was lowest over the southern Plateau region. The pressure was slightly above the normal from southeastern Wyoming southeastward to the Louisiana coast, and southward to the middle Rio Grande Valley; also over the western parts of the middle and northern Plateau regions and in the north and middle Pacific districts; elsewhere it was below the normal, with marked departures east of the Mississippi River, the greatest minus departures occurring over eastern Ohio, southwestern New York, the Middle Atlantic States, the Virginias, and north-central North Carolina.

The pressure increased over that of March, 1903, in the middle and north Pacific regions, and the western parts of the northern and middle Plateau districts, the greatest plus changes occurring along the coasts of northwestern California, and Oregon; elsewhere the pressure diminished from that of March, with quite marked changes east of the one hundred and tenth meridian, the greatest minus changes occurring over the northeastern portion of the country.

TEMPERATURE OF THE AIR.

The distribution of maximum, minimum, and average surface temperatures is graphically shown by the lines on Chart VI.

The temperature was above normal in the Atlantic States north of northeastern North Carolina, in the region from eastern Montana, central South Dakota, and western Nebraska eastward to the Atlantic Ocean, and in the eastern part of Colorado, the extreme western part of Texas, and New Mexico, with the greatest plus departures in Michigan, southeastern Wisconsin, northern Minnesota, and parts of South Dakota; elsewhere the temperature was below normal, with decided minus departures in the States from Kentucky southward to northern Florida, and from east-central California and northwestern Arizona northward to Canadian Territory.

Maximum temperatures of 90° or higher occurred in a small area overlying the northern parts of Virginia, Maryland, Delaware, and southeastern New Jersey, and in central Oklahoma, central Texas, extreme southeastern California, and western and south-central Arizona. A maximum of 103° was reported from southeastern California. Minimum temperatures of 32° or lower were reported from all States except Florida.

The average temperatures for the several geographic districts and the departures from the normal values are shown in the following table:

Average temperatures and departures from normal.

Districts.	Number of stations.	Average temperatures for the current month.	Departures for the current month.	Accumulated departures since January 1.	Average departures since January 1.
		°	°	°	°
New England	8	44.8	+ 1.8	+13.5	+ 3.4
Middle Atlantic	12	52.5	+ 1.9	+13.4	+ 3.4
South Atlantic	10	60.3	− 1.1	+ 5.9	+ 1.5
Florida Peninsula*	8	68.7	− 1.9	+ 5.9	+ 1.5
East Gulf	9	63.6	− 2.4	− 2.1	− 0.5
West Gulf	7	65.4	− 1.7	− 2.4	− 0.6
Ohio Valley and Tennessee	11	55.0	− 1.1	+ 5.3	+ 1.3
Lower Lake	8	46.2	+ 1.5	+12.1	+ 3.0
Upper Lake	10	42.2	+ 2.0	+14.3	+ 3.6
North Dakota*	8	43.9	+ 2.0	+ 6.3	+ 1.6
Upper Mississippi Valley	11	51.7	+ 0.6	+ 9.1	+ 2.3
Missouri Valley	11	51.5	+ 0.6	+ 6.0	+ 1.5
Northern Slope	7	44.4	− 0.2	+ 2.4	+ 0.6
Middle Slope	6	53.8	− 0.4	− 0.4	− 0.1
Southern Slope*	6	60.6	− 0.5	− 3.4	− 0.8
Southern Plateau*	13	54.9	− 1.3	− 5.7	− 1.4
Middle Plateau*	8	45.6	− 2.1	−14.5	− 3.6
Northern Plateau*	12	44.9	− 2.1	+ 0.9	+ 0.2
North Pacific	7	46.8	− 1.9	− 1.1	− 0.3
Middle Pacific	5	53.1	− 1.4	− 5.7	− 1.4
South Pacific	4	57.4	− 1.3	− 2.5	− 0.6

*Regular Weather Bureau and selected voluntary stations.

In Canada.—Prof. R. F. Stupart says:

The temperature was below the average over British Columbia, and in Alberta, Saskatchewan and western Assiniboia, and elsewhere in the Dominion above the average, except to the northward of Lake Superior and in portions of the Gulf of St. Lawrence. In British Columbia and the Northwest Territories the negative departures varied between 1° and 4°, whereas the plus departures were from 2° to 3° in Manitoba; from 1° to 5° in Ontario; from 1° to 3° in Quebec, and from 0° to 2° in the Maritime Provinces.

PRECIPITATION.

The distribution of total monthly precipitation is shown on Chart III.

The precipitation was in excess in southeastern New England, the lower Lake region, and parts of the upper Lake region, Ohio Valley, Middle Atlantic States, and the Carolinas, and in northern Missouri, Kansas, southeastern Nebraska, eastern Iowa, southern and central Minnesota, Wisconsin, northern Illinois, the upper Rio Grande Valley, western parts of New Mexico and Colorado, southern and eastern Utah, southern California, Arizona, except the extreme southeastern part, west-central South Dakota, and south-central Montana; elsewhere it was deficient, the greatest minus departures being reported from the Gulf States.

Snow occurred during the month, except in Delaware, eastern Maryland, the South Atlantic and Gulf States, western Tennessee, the southern parts of Oklahoma, New Mexico, Arizona, and California. At the end of the month the winter's snow had disappeared, except on the high ranges of the Rocky and Sierra Nevada Mountains. On the last two days of the month considerable snow fell over the States of Kansas, Nebraska, Iowa, Minnesota, Wisconsin, and Michigan, generally melting as it fell, but small amounts of this still remained on the ground in scattered localities at the close of the month.

Average precipitation and departure from the normal.

Districts.	Number of stations.	Average.		Departure.	
		Current month.	Percentage of normal.	Current month.	Accumulated since Jan. 1.
		Inches.		*Inches.*	*Inches.*
New England	8	3.35	113	+0.2	+2.1
Middle Atlantic	12	2.80	85	−0.5	+1.0
South Atlantic	10	3.02	88	−0.4	+1.2
Florida Peninsula *	8	0.59	26	−1.7	+6.1
East Gulf	9	1.49	32	−3.1	+3.5
West Gulf	7	1.12	29	−2.7	+0.7
Ohio Valley and Tennessee	11	3.87	97	−0.1	+0.1
Lower Lake	8	3.92	169	+1.6	+2.0
Upper Lake	10	2.70	117	+0.4	−0.2
North Dakota *	8	0.96	49	−1.0	−1.6
Upper Mississippi Valley	11	3.47	113	+0.4	−0.6
Missouri Valley	11	2.52	86	−0.4	−1.0
Northern Slope	7	1.72	100	0.0	−0.1
Middle Slope	6	1.74	81	−0.4	−0.2
Southern Slope *	6	1.20	48	−1.3	+0.9
Southern Plateau *	13	0.93	176	+0.4	−0.1
Middle Plateau *	8	1.09	110	+0.1	0.0
Northern Plateau *	12	0.66	57	−0.5	−2.3
North Pacific	7	2.58	62	−1.6	−6.2
Middle Pacific	5	0.63	26	−1.8	−2.1
South Pacific	4	1.83	138	+0.5	+0.8

* Regular Weather Bureau and selected voluntary stations.

In Canada.—Professor Stupart says:

In the Maritime Provinces and over the eastern part of Quebec the precipitation was everywhere above the average, St. John, N. B., recording as much as 3.1 inches above; elsewhere, except locally, the average was not maintained, the Ottawa Valley and the northern portion of the Lake region being especially deficient in rainfall. The exceptions where the average was exceeded were Lakes Erie and Ontario and their environs, northwestern Saskatchewan, northern Alberta, and northern British Columbia. At the close of the month a considerable amount of snow lay on the ground on the north shores of Lake Superior, both in the bush and also in the open country. In Cariboo, also, 1 foot was still reported on the level ground, with very deep snow on the mountains.

HAIL.

The following are the dates on which hail fell in the respective States:

Alabama, 7, 8, 12, 13, 19, 20. Arizona, 2, 9, 17, 28. Arkansas, 6, 7, 8, 9, 11, 12, 13, 18, 19, 21, 29. California, 1, 2, 9, 10, 13, 14, 15, 16, 17, 26. Colorado, 1, 2, 9, 12, 15, 21, 24, 25, 26, 28. Connecticut, 4, 24. Delaware, 4. District of Columbia, 4. Florida, 13. Georgia, 3, 8, 12, 13, 14, 19, 20, 26. Idaho, 1, 3, 5, 8, 9, 10, 11, 15, 18, 20, 22, 26, 28. Illinois, 3, 10, 11, 12, 19, 25, 30. Indiana, 3, 11, 12, 13, 19. Indian Territory, 12, 18. Iowa, 1, 10, 11, 12, 19, 27, 28, 29. Kansas, 2, 3, 7, 10, 12, 17, 18, 19, 22, 23, 28, 29, 30. Kentucky, 3, 8, 12, 13, 19, 20, 30. Maine, 4, 11, 16, 19. Maryland, 3, 4, 12. Massachusetts, 4, 16. Michigan, 1, 2, 3, 11, 12, 14, 24, 30. Minnesota, 2, 6, 10. Mississippi, 8, 19, 25. Missouri, 3, 6, 7, 8, 10, 11, 12, 13, 14, 18, 19, 20, 24, 29. Montana, 9, 18. Nebraska, 11, 17, 18, 27, 28, 29. Nevada, 1, 10, 16, 17, 27. New Jersey, 4, 14. New Mexico, 26. New York, 3, 4, 7, 14, 15, 22. North Carolina, 14, 15, 20, 21, 22, 26. North Dakota, 12. Ohio, 3, 11, 12, 20, 24, 25, 30. Oklahoma, 29. Oregon, 3, 4, 5, 9, 10, 11, 13, 14, 17, 18, 26. Pennsylvania, 2, 3, 12. Rhode Island, 31. South Carolina, 12, 14, 17, 20, 21, 25, 26. South Dakota, 28, 29. Tennessee, 3, 7, 8, 9, 12, 13, 14, 19, 20, 21, 22, 26. Texas, 8, 12, 18, 23, 28, 29. Utah, 1, 9, 10, 17, 18, 19, 22, 27, 28. Vermont, 10. Virginia, 14. Washington, 2, 3, 4, 5, 7, 8, 9, 10, 11, 13, 14, 17, 18, 19, 20, 22. West Virginia, 13, 19, 23. Wisconsin, 1, 2, 12, 28, 30. Wyoming, 2, 21.

SLEET.

The following are the dates on which sleet fell in the respective States:

Arizona, 2, 9. Arkansas, 3. California, 9, 10. Colorado, 10, 17, 20, 21, 28, 29. Connecticut, 4. Delaware, 4. Idaho, 4, 11, 30. Illinois, 3, 21, 25, 30. Indiana, 3, 4, 22. Iowa, 3, 6, 23, 28, 29, 30. Kansas, 2, 3, 12, 28, 29, 30. Kentucky, 3, 22. Maine, 4, 5, 7, 15, 16, 17, 25. Maryland, 4. Massachusetts, 4, 15, 16. Michigan, 1, 2, 3, 6, 7, 8, 13, 14, 15, 28, 29, 30. Minnesota, 6, 7, 28, 29, 30. Missouri, 23, 29, 30. Montana, 2, 9, 10, 11, 16, 18. Nebraska, 7, 28, 29, 30. Nevada, 1, 14. New Hampshire, 4. New Jersey, 4, 5. New Mexico, 2, 23, 29. New York, 3, 4, 14, 15, 16, 22. North Dakota, 27. Ohio, 3, 4, 11, 22, 23, 24. Oregon, 4, 9, 10. Pennsylvania, 4, 23. South Dakota, 6, 28, 29. Tennessee, 3, 14, 22, 26. Utah, 1, 2, 10, 11, 17, 18, 27, 28. Vermont, 15, 16. Virginia, 5. Washington, 3, 5, 6, 7, 8, 9, 10, 14. West Virginia, 4. Wisconsin, 1, 2, 14, 15, 21, 24, 28, 29, 30. Wyoming, 1, 5, 25, 28.

SUNSHINE AND CLOUDINESS.

The distribution of sunshine is graphically shown on Chart VII, and the numerical values of average daylight cloudiness, both for individual stations and by geographical districts, appear in Table I.

The averages for the various districts, with departures from the normal, are shown in the following table:

Average cloudiness and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
New England	5.2	− 0.1	Missouri Valley	5.0	− 0.4
Middle Atlantic	5.4	+ 0.2	Northern Slope	5.0	− 0.4
South Atlantic	4.8	+ 0.4	Middle Slope	4.2	− 0.2
Florida Peninsula	3.5	− 0.4	Southern Slope	4.9	+ 0.7
East Gulf	4.4	− 0.1	Southern Plateau	2.8	+ 0.5
West Gulf	4.5	− 0.7	Middle Plateau	4.2	− 0.3
Ohio Valley and Tennessee	6.0	+ 0.7	Northern Plateau	5.7	− 0.6
Lower Lake	5.2	− 0.3	North Pacific	6.8	+ 0.3
Upper Lake	5.8	+ 0.1	Middle Pacific	3.3	− 1.3
North Dakota	4.7	− 0.8	South Pacific	3.9	0.0
Upper Mississippi Valley	5.9	+ 0.4			

HUMIDITY.

The averages by districts appear in the subjoined table:

Average relative humidity and departures from the normal.

Districts.	Average.	Departure from the normal.	Districts.	Average.	Departure from the normal.
	%			%	
New England	72	− 1	Missouri Valley	63	− 2
Middle Atlantic	67	0	Northern Slope	62	+ 4
South Atlantic	69	− 3	Middle Slope	60	+ 3
Florida Peninsula	70	− 4	Southern Slope	55	0
East Gulf	73	+ 3	Southern Plateau	33	+ 3
West Gulf	68	− 4	Middle Plateau	51	+ 6
Ohio Valley and Tennessee	69	+ 4	Northern Plateau	59	+ 2
Lower Lake	73	+ 3	North Pacific	76	0
Upper Lake	70	− 3	Middle Pacific	66	− 4
North Dakota	66	− 2	South Pacific	71	+ 3
Upper Mississippi Valley	68	0			

ATMOSPHERIC ELECTRICITY.

Numerical statistics relative to auroras and thunderstorms are given in Table IV, which shows the number of stations from which meteorological reports were received, and the number of such stations reporting thunderstorms (T) and auroras (A) in each State and on each day of the month, respectively.

Thunderstorms.—Reports of 2677 thunderstorms were received during the current month as against 2404 in 1902 and 2149 during the preceding month.

The dates on which the number of reports of thunderstorms for the whole country was most numerous were: 12th, 335; 11th, 176; 19th, 166.

Reports were most numerous from: Missouri, 301; Iowa, 164; Illinois, 148; Tennessee, 147.

Auroras.—The evenings on which bright moonlight must have interfered with observations of faint auroras are assumed to be the four preceding and following the date of full moon, viz: 7th to 15th.

In Canada: Thunderstorms were reported at St. John, N. F., 18th; Bissett, 2d: Toronto, 30th; Port Stanley, 2d, 3d; Parry Sound, 2d, 30th; Medicine Hat, 22d; Hamilton, Bermuda, 22d, Sable Island, 24th. Auroras were reported at Quebec, 26th; Montreal, 2d; Minnedosa, 27th; Swift Current, 5th.

WIND.

The maximum wind velocity at each Weather Bureau station for a period of five minutes is given in Table I, which also gives the altitude of Weather Bureau anemometers above ground.

Following are the velocities of 50 miles and over per hour registered during the month:

Maximum wind velocities.

Stations.	Date.	Velocity.	Direction.	Stations.	Date.	Velocity.	Direction.
Amarillo, Tex	2	50	w.	Mount Tamalpais, Cal	17	51	nw.
Atlanta, Ga	3	50	nw.	Do	18	56	nw.
Block Island, R. I	4	54	nw.	Do	25	55	nw.
Do	14	55	ne.	Do	26	67	nw.
Do	15	60	ne.	New York, N. Y	4	55	nw.
Do	16	53	ne.	Do	15	52	ne.
Do	17	51	n.	Do	18	53	nw.
Buffalo, N. Y	9	51	w.	North Head, Wash	21	50	se.
Do	30	52	w.	Point Reyes Light, Cal	1	77	nw.
Cape Henry, Va	4	55	nw.	Do	2	58	nw.
Chicago, Ill	2	53	s.	Do	3	60	nw.
Do	3	51	ne.	Do	4	71	nw.
Cleveland. Ohio	3	50	nw.	Do	5	52	nw.
Columbus, Ohio	12	52	sw.	Do	9	62	nw.
El Paso, Tex	2	73	sw.	Do	10	60	nw.
Fort Smith, Ark	3	50	w.	Do	17	55	nw.
Hatteras, N. C	4	53	n.	Do	22	58	nw.
Do	14	52	w.	Do	23	52	nw.
Jacksonville, Fla	13	51	sw.	Do	25	59	nw.
Lexington, Ky	8	50	nw.	Do	26	70	nw.
Memphis, Tenn	3	56	w.	Syracuse, N. Y	2	55	s.
Do	8	64	nw.	Do	30	58	nw.
Mount Tamalpais, Cal	4	54	nw.	Tatoosh Island, Wash	3	50	sw.
Do	5	56	n.	Do	5	51	sw.
Do	9	71	nw.	Do	6	55	sw.
Do	10	56	nw.	Do	7	55	nw.
Do	13	50	nw.	Valentine, Nebr	17	55	se.
Do	14	59	nw.				

DESCRIPTION OF TABLES AND CHARTS.

By Mr. W. B. STOCKMAN, Forecast Official, in charge of Division of Meteorological Records.

For description of tables and charts see page 582 of REVIEW for December, 1902.

TABLE 1.—*Climatological data for Weather Bureau Stations, April, 1903.*

Stations.	Elevation of instruments. Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Temperature of the air, in degrees Fahrenheit. Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Precipitation, in inches. Total.	Departure from normal.	Days with .01, or more.	Wind. Total movement, miles.	Prevailing direction.	Maximum velocity. Miles per hour.	Direction.	Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
New England.							44.8	+ 1.8										72	3.35	+ 0.2										5.2	
Eastport	76	69	82	29.78	29.87	— .06	39.4	+ 0.8	72	29	46	17	6	33	32	36	33	81	3.33	+ 0.3	11	9,345	nw.	42	sw.	3	6	14	10	6.2	8.0
Portland, Me.	103	81	117	29.77	29.89	— .07	43.2	+ 0.2	78	29	51	22	6	35	31	39	32	68	2.51	— 0.5	7	8,005	nw.	42	se.	3	11	12	7	4.9	T.
Concord	298	70	79	29.57	29.89	— .10	44.6	+ 0.3	84	30	56	21	6	33	42	.....	.....	.....	1.62	— 1.2	8	4,966	nw.	27	e.	14	11	10	9	5.3	0.5
Northfield	876	16	60	28.96	29.92	— .07	40.8	+ 1.5	82	30	52	14	5	30	44	36	30	66	0.97	— 1.1	7	6,840	n.	38	se.	2	7	10	13	5.8	1.2
Boston	125	115	181	29.75	29.89	— .08	47.8	+ 2.7	83	29	56	26	6	40	31	42	35	65	4.43	+ 1.0	9	8,997	nw.	40	ne.	15	15	6	9	4.6	T.
Nantucket	12	43	85	29.86	29.87	— .10	45.7	+ 2.6	73	29	50	28	5	41	24	43	39	81	3.04	— 0.5	10	12,244	n.	48	n.	17	4	17	9	6.2	0.2
Block Island	26	11	60	29.87	29.90	— .08	46.8	+ 3.4	72	29	53	28	5	41	29	42	38	76	5.61	+ 2.2	10	13,556	sw.	60	ne.	15	14	8	8	4.8	
Narragansett	.....	10	38	.....	.....	.....	46.2	+ 2.0	84	29	55	26	*	38	44	.....	.....	.....	6.05	+ 2.4	9	.....	nw.	.....	.....	.....	15	6	9	.....	
New Haven	106	117	140	29.77	29.89	— .10	48.8	+ 2.7	84	29	57	25	5	40	34	43	36	65	2.61	— 0.9	9	8,420	n.	40	n.	17	16	7	7	3.6	0.1
Mid. Atlantic States.							52.5	+ 1.9										67	2.80	— 0.5										5.4	
Albany	97	102	115	29.81	29.91	— .09	48.2	+ 2.2	86	30	58	23	5	39	37	39	36	68	0.79	— 1.7	9	6,584	nw.	34	se.	2	14	6	10	4.8	1.0
Binghamton	875	79	90	28.98	29.92	— .10	45.4	— 0.1	84	30	56	21	5	35	41	.....	.....	.....	1.57	— 0.7	10	5,198	n.	30	sw.	3	10	11	9	5.4	0.3
New York	314	108	350	29.54	29.89	— .11	52.2	+ 4.1	85	30	60	28	5	45	35	45	38	64	2.88	— 0.5	9	11,308	nw.	55	nw.	4	12	6	12	5.1	T.
Harrisburg	374	94	104	29.51	29.91	— .11	51.5	+ 1.4	86	30	60	25	5	43	31	44	35	57	3.24	— 0.2	8	6,304	e.	37	sw.	3	9	6	15	5.9	
Philadelphia	117	168	184	29.77	29.90	— .11	53.2	+ 2.7	90	30	61	27	5	45	38	47	40	65	3.00	0.0	9	8,535	n.	37	sw.	3	10	7	13	5.5	0.1
Scranton	805	111	119	29.05	29.92	— .09	47.6	.....	86	30	57	23	5	38	38	41	33	59	2.55	.....	7	6,401	n.	36	se.	14	12	5	13	5.6	0.1
Atlantic City	52	39	48	29.84	29.90	— .10	49.9	+ 3.1	83	29	56	26	5	43	30	46	42	77	2.49	— 0.8	8	7,322	sw.	34	ne.	14	10	9	11	5.3	0.1
Cape May	17	47	51	29.89	29.91	— .08	50.6	+ 2.4	81	29	56	29	5	45	29	46	.....	.....	2.40	— 0.8	12	7,226	s.	36	ne.	14	13	6	11	5.1	T.
Baltimore	123	69	117	29.76	29.89	— .12	54.4	+ 1.3	91	30	63	27	5	46	40	46	37	56	3.29	— 0.1	9	6,449	nw.	31	nw.	8	13	3	14	5.6	
Washington	112	59	76	29.78	29.91	— .11	54.0	+ 1.0	89	30	64	26	5	44	41	49	44	74	4.29	+ 1.0	11	6,344	nw.	36	nw.	4	12	6	12	5.3	
Cape Henry	18	11	58	29.88	29.90	— .10	56.8	+ 2.2	90	30	64	34	5	50	31	.....	.....	.....	2.74	— 1.7	14	11,413	sw.	55	nw.	4	8	8	14	6.0	
Lynchburg	681	83	88	29.15	29.89	— .13	56.1	+ 0.2	87	30	67	29	5	46	42	48	41	64	2.53	— 0.8	10	3,800	nw.	34	nw.	8	13	6	11	5.4	
Norfolk	91	102	111	29.81	29.91	— .10	58.0	+ 1.8	86	30	66	30	5	50	34	53	49	80	4.34	+ 0.3	11	7,464	s.	37	sw.	8	12	7	11	5.2	
Richmond	144	82	90	29.77	29.92	— .10	57.8	.....	88	30	67	31	5	48	34	.....	.....	.....	4.46	.....	13	4,931	n.	33	s.	3	9	7	14	5.6	
Wytheville	2,293	40	47	27.55	29.94	— .09	50.6	.....	79	30	61	22	5	40	39	44	39	71	3.67	.....	12	4,417	w.	30	w.	8	12	7	11	5.4	T.
S. Atlantic States.							60.3	— 1.1										69	3.02	— 0.4										4.8	
Asheville	2,255	73	100	27.61	29.94	— .09	52.5	— 2.1	82	29	63	26	5	42	39	46	41	71	4.38	+ 1.3	12	7,305	n.	40	nw.	4	8	10	12	6.1	T.
Charlotte	773	68	76	29.10	29.94	— .09	58.8	— 0.9	83	29	68	32	5	49	29	51	45	67	3.28	— 0.3	13	5,746	s.	27	sw.	3	10	7	13	5.7	
Hatteras	11	12	47	29.92	29.93	— .08	60.4	+ 3.2	80	30	66	38	5	55	24	55	52	78	1.74	— 3.0	9	11,852	sw.	53	n.	4	9	9	12	5.4	
Kittyhawk	8	12	30	.....	.....	.....	56.9	+ 1.1	84	30	64	34	5	50	28	.....	.....	.....	4.89	+ 0.4	10	11,474	sw.	.....	.....	.....	15	4	11	.....	
Raleigh	376	93	101	29.52	29.93	— .10	58.8	0.0	87	29	68	30	5	49	32	51	45	66	5.92	+ 2.6	14	5,537	sw.	30	sw.	3	11	6	13	5.2	
Wilmington	78	82	90	29.85	29.93	— .10	61.0	— 0.5	86	30	70	35	5	52	32	54	49	72	2.05	— 0.9	12	7,122	sw.	40	w.	14	11	8	11	5.0	
Charleston	48	14	92	29.93	29.97	— .06	63.1	— 1.5	82	30	71	41	5	55	23	56	51	70	0.96	— 2.6	7	8,461	sw.	35	s.	3	10	17	3	4.3	
Columbia	351	114	122	29.58	29.97	— .06	60.8	— 2.8	85	29	71	35	5	50	29	53	48	67	3.11	+ 0.3	10	6,967	sw.	36	sw.	14	11	11	8	4.8	
Augusta	180	89	97	29.77	29.97	— .06	61.4	— 2.8	84	10	73	39	5	50	34	53	47	66	3.83	+ 0.5	10	5,475	nw.	30	nw.	4	15	11	4	3.5	
Savannah	65	79	89	29.91	29.98	— .05	63.7	— 2.4	83	30	73	45	5	55	26	55	50	69	1.53	— 1.9	4	6,793	sw.	32	w.	4	13	14	3	4.0	
Jacksonville	43	101	129	29.93	29.98	— .06	65.5	— 3.4	82	20	74	47	5	57	24	58	52	68	1.54	— 1.3	4	8,130	sw.	51	sw.	13	14	11	5	3.9	
Florida Peninsula.							71.4	— 1.7										70	0.58	— 1.5										3.5	
Jupiter	28	10	48	29.96	29.99	— .05	71.8	— 0.2	85	*	78	53	24	65	21	64	60	69	0.44	— 2.3	5	8,666	e.	33	sw.	16	14	16	0	4.0	
Key West	22	43	50	29.98	29.99	— .03	74.1	— 2.0	82	8	78	64	24	70	11	66	62	69	0.55	— 0.7	4	8,190	e.	30	nw.	14	15	12	3	3.5	
Tampa	34	60	67	29.97	30.00	— .06	68.2	— 2.9	84	10	77	48	24	59	27	60	56	71	0.74	— 1.6	3	5,224	nw.	22	w.	16	20	8	2	2.9	
East Gulf States.							63.6	— 2.4										73	1.49	— 3.1										4.4	
Atlanta	1,174	190	216	28.74	29.98	— .05	58.5	— 3.1	80	29	67	36	4	50	32	54	52	83	3.33	— 0.4	11	11,194	nw.	50	nw.	3	9	10	11	5.4	
Macon	370	93	99	29.59	29.99	— .04	60.9	.....	81	29	71	38	5	50	33	.....	.....	.....	4.47	.....	9	5,558	nw.	38	w.	13	12	4	14	5.4	
Pensacola	56	79	96	29.96	30.02	.00	65.2	— 2.5	81	20	72	47	5	59	23	.....	.....	.....	0.10	— 3.4	2	8,865	nw.	36	n.	4	20	7	3	3.1	
Mobile	57	88	96	29.95	30.01	— .01	65.0	— 1.9	83	9	74	45	5	56	29	58	53	72	0.64	— 4.1	4	6,855	s.	30	nw.	3	19	7	4	3.3	
Montgomery	223	100	112	29.75	29.98	— .05	62.5	— 2.9	84	3	73	39	5	52	33	56	52	74	3.04	— 1.8	9	5,968	se.	34	nw.	3	13	10	7	4.3	
Meridian	375	84	93	29.60	29.99	— .03	62.0	— 3.6	85	12	74	37	5	50	40	.....	.....	.....	1.35	— 3.0	5	5,508	s.	28	sw.	3	13	11	6	4.4	
Vicksburg	247	62	74	29.69	29.95	— .05	64.4	— 1.4	85	9	74	44	4	55	28	56	51	67	1.00	— 4.9	2	6,790	s.	36	nw.	13	13	11	6	4.3	
New Orleans	51	88	121	29.95	30.00	.00	67.8	— 1.2	85	12	76	48	4	59	24	60	55	71	0.97	— 4.2	1	7,221	sw.	32	n.	4	12	11	7	4.8	
West Gulf States.							65.4	— 1.7										68	1.12	— 2.7										4.5	
Shreveport	249	77	84	29.72	29.98	+ .01	65.0	— 1.4	85	8	75	43	30	55	32	56	49	62	1.41	— 3.8	3	6,661	s.	34	w.	3	15	7	8	4.4	
Fort Smith	457	79	94	29.45	29.94	— .02	61.8	— 0.4	86	2	73	36	4	51	32	52	45	61	0.36	— 4.7	6	8,691	e.	50	w.	3	10	20	0	3.8	
Little Rock	357	93	100	29.59	29.96	— .02	62.0	— 1.2	83	2	71	38	4	53	32	53	46	60	1.58	— 3.2	7	7,807	s.	39	nw.	3	17	11	2	3.5	T.
Corpus Christi	20	48	53	29.96	29.98	+ .03	69.7	— 1.6	88	19	75	52	30	64	25	64	60	77	0.84	— 0.7	3	9,180	se.	42	e.	29	7	17	6	5.4	
Fort Worth	670	106	114	29.28	29.99	+ .05	64.4	.....	90	1	76	35	30	53	34	.....	.....	.....	0.59	.....	2	9,976	s.	44	w.	3	19	9	2	2.9	
Galveston	54	106	112	29.92	29.98	+ .01	67.6	— 2.0	81	20	72	52	4	63	18	62	59	78	1.14	— 1.7	6	9,424	se.	37	se.	3	15	8	7	4.5	
Palestine	510	73	79	29.46	30.00	+ .04	64.6	— 2.1	84	8	74	40	30	55	28	56	50	66	0.80	— 3.8	3	7,467	s.	34	nw.	3	9	10	11	5.5	
San Antonio	701	80	91	29.24	29.97	+ .04	67.1	— 3.0	89	19	76	44	4	58	29	59	54	69	1.74	— 1.2	3	5,765	se.	33	nw.	3	5	15	10	6.0	
Taylor	583	55	63	29.37	29.98	+ .03	66.0	.....	86	8	76	40	30	56	32	.....	.....	.....	0.75	.....	4	8,378	s.	33	se.	28	11	14	5	4.7	
Ohio Val. and Tenn.							55.0	— 1.1										69	3.87	— 0.1										6.0	
Chattanooga	762	106	112	29.18	29.98	— .05	57.8	— 3.1	83	29	68	34	4	48	37	49	42	62	3.51	— 1.0	11	6,715	s.	43	nw.	3	11	12	7	5.0	
Knoxville	1,004	10	88	28.88	29.95	— .08	56.2	— 2.0	84	29	67	30	5	45	38	49	44	73	7.21	+ 2.3	13	6,426	sw.	45	sw.	3	13	7	10	5.0	
Memphis	397	140	154	29.56	29.98	— .02	61.6	— 0.5	81	2	70	42	4	53	31	55	51	72	2.69	— 2.8	8	9,234	nw.	64	nw.	8	9	10	11	5.6	
Nashville	546	122	134	29.40	29.99	— .02	57.6	— 2.2	82	29	68	33	4	48	36	50	45	69	4.00	— 0.8	11	6,829	nw.	37	sw.	3	10	9	11	5.3	
Lexington	989	75	102	28.86	29.93	— .09	53.4	— 2.5	80	29	62	25	5	44	37	.....	.....	.....	3.29	— 0.4	17	9,426	s.	50	nw.	8	5	12	13	6.4	T.
Louisville	525	114	136	29.36	29.96	— .05	56.0	— 0.4	84	29	66	29	5	46	38	48	43	66	4.82	+ 0.4	15	6,977	s.	46	w.	3	8	10	12	6.1	T.
Evansville	431	72	82	29.44	29.91	— .09	55.9	.....	80	29	65	31	4	47	37	.....	.....	.....	3.17	.....	13	6,367	s.	42	sw.	3	7	9	14	6.3	T.
Indianapolis	822	154	164	29.04	29.93	— .07	52.3	— 0.6	79	29	61	26	4	44	40	47	42	74	3.72	0.0	14	9,019	s.	42	s.	2	9	10	11	5.9	T.
Cincinnati	628	152	160	29.25	29.93	— .08	53.6	— 1.0	80	29	63	28	5	44	38	47	41	68	3.49	+ 0.3	15	5,578	sw.	42	sw.	3	7	8	15	6.5	T.
Columbus	824	173	190	29.04	29.91	— .11	51.2	0.0	80	29	60	26	4	42	41	45	40	69	2.47	— 0.7	14	9,441	sw.	52	sw.	12	7	7	16	6.7	T.
Pittsburg	842	116	123	29.02	29.92	— .10	51.6	+ 0.4	83	30	61	24	5	42	40	45	38	61	2.82	0.0	12	4,272	ne.	30	nw.	30	9	8	13	5.8	T.
Parkersburg	638	77	84	29.25	29.93	— .10	53.2	— 0.6	83	30	63	25	5	43	42	47	41	69	4.59	+ 1.6	15	4,654	n.	42	nw.	12	7	5	18	6.9	T.
Elkins	1,940	41	50	27.87	29.93	— .10	48.3	.....	84	30	61	14	5	36	46	42	38	74	3.38	.....	14	3,448	nw.	32	w.	30	7	9	14	6.6	1.2
Lower Lake Region.							46.2	+ 1.5										73	3.92	+ 1.6										5.2	
Buffalo	767	178	206	29.09	29.93	— .08	44.4	+ 2.7	72	30	52	21	5	37	38	40	36	76	4.48	+ 2.0	15	10,226	sw.	52	w.	30	8	9	13	5.8	1.0
Oswego	335	76	91	29.55	29.92	— .09	43.2	+ 0.9	85	30	50	21	4	36	47	39	33	70	3.25	+ 1.2	10	7,982	w.	34	w.	30	15	5	10	4.4	0.6
Rochester	523	81	102	29.36	29.94	— .07	45.4	+ 1.9	85	30	54	23	4	37	50	41	36	74	2.81	+ 0.3	11	6,786	nw.	37	nw.	30	11	8	11	5.3	0.3
Syracuse	597	97	113	29.28	29.93	— .08	44.5	.....	84	30	53	20	5	36	46	.....	.....	.....	2.34	.....	10	9,499	nw.	58	nw.	30	11	7	12	5.6	0.2
Erie	713	92	102	29.15	29.92	— .10	45.5	+ 1.4	80	30	53	20	5	38	44	41	36	73	3.81	+ 1.3	15	7,466	w.	42	s.	13	11	6	13	5.9	0.4
Cleveland	762	190	201	29.10	29.91	— .11	47.2	+ 1.5	80	29	55	22	5	40	40	43	38	74	3.85	+ 1.6	15	11,432	n.	50	nw.	3	11	9	10	5.1	0.6
Sandusky	629	62	70	29.24	29.92	— .10	48.4	+ 1.4	81	29	56	26	4	41	39	.....	.....	.....	3.96	+ 1.5	14	7,077	ne.	36	w.	30	14	9	7	4.2	0.3
Toledo	628	120	127	29.24	29.92	— .09	48.2	+ 0.7	80	29	57	22	4	39	40	42	36	68	3.67	+ 1.4	10	8,563	ne.	36	w.	9	12	8	10	5.1	1.4
Detroit	730	153	193	29.13	29.92	— .10	46.9	+ 1.2	79	29	55	22	4	38	36	41	37	75	5.51	+ 3.3	13	9,893	ne.	41	sw.	30	13	7	10	5.0	4.9
Upper Lake Region.							42.2	+ 2.0										70	2.70	+ 0.4										5.6	
Alpena	609	63	80	29.29	29.96	— .06	40.2	+ 3.1	76	28	48	19	5	33	34	36	30	70	2.00	— 0.2	10	8,711	se.	38	nw.	2	10	4	16	6.2	T.
Escanaba	612	43	57	29.30	29.98	— .04	38.4	+ 2.6	60	26	45	18	4	32	25	35	31	79	1.69	— 0.4	10	8,432	n.	34	n.	15	12	3	15	5.6	3.8
Grand Haven	632	54	92	29.23	29.92	— .09	45.0	+ 1.4	69	29	53	22	5	37	30	40	36	74	4.92	+ 2.4	11	10,469	ne.	38	n.	2	9	7	14	6.1	T.
Houghton	668	66	74	29.24	29.97	— .05	39.3	.....	76	27	47	21	4	32	40	.....	.....	.....	3.70	.....	10	5,626	e.	29	n.	2	12	5	13	5.6	14.2
Marquette	734	79	116	29.18	30.00	— .02	38.5	+ 1.3	71	27	43	23	4	34	36	33	26	64	3.60	+ 1.6	13	8,027	nw.	36	nw.	30	9	6	15	6.3	12.0
Port Huron	638	70	120	29.25	29.95	— .07	44.1	+ 2.4	80	29	52	20	5	36	42	39	34	73	2.19	+ 0.1	14	10,144	ne.	43	n.	3	13	7	10	5.0	3.2
Sault Ste. Marie	614	40	61	29.27	29.95	— .08	39.4	+ 1.7	68	28	47	14	4	32	31	33	25	61	1.19	— 0.4	10	7,195	nw.	33	nw.	9	12	9	9	5.0	1.8
Chicago	823	241	274	29.03	29.93	— .07	47.2	+ 1.6	78	29	54	28	4	40	36	42	38	75	3.77	+ 0.7	13	15,289	ne.	53	s.	2	10	7	13	5.7	3.2
Milwaukee	681	124	142	29.19	29.94	— .05	45.6	+ 2.9	70	28	53	26	4	38	31	39	35	74	2.68	— 0.2	12	10,792	n.	42	n.	14	8	8	14	6.2	2.3
Green Bay	617	49	86	29.27	29.94	— .07	43.7	+ 0.7	68	27	52	21	4	35	31	38	32	69	2.79	+ 0.2	12	11,303	ne.	46	ne.	13	8	7	15	6.3	0.2
Duluth	702	95	116	29.20	29.98	— .03	40.0	+ 2.1	73	27	46	22	3	34	26	35	28	64	2.16	— 0.3	11	8,332	ne.	38	sw.	27	11	8	11	5.5	6.8

TABLE I.—*Climatological data for Weather Bureau Stations, April, 1903*—Continued.

Stations.	Elevation of instruments.			Pressure, in inches.			Temperature of the air, in degrees Fahrenheit.												Precipitation, in inches.			Wind.									
	Barometer above sea level, feet.	Thermometers above ground.	Anemometer above ground.	Actual, reduced to mean of 24 hours.	Sea level, reduced to mean of 24 hrs.	Departure from normal.	Mean max. + mean min. ÷ 2.	Departure from normal.	Maximum.	Date.	Mean maximum.	Minimum.	Date.	Mean minimum.	Greatest daily range.	Mean wet thermometer.	Mean temperature of the dew-point.	Mean relative humidity, per cent.	Total.	Departure from normal.	Days with .01, or more.	Total movement, miles.	Prevailing direction.	Maximum velocity: Miles per hour.	Maximum velocity: Direction.	Maximum velocity: Date.	Clear days.	Partly cloudy days.	Cloudy days.	Average cloudiness, tenths.	Total snowfall.
North Dakota.							43.6	+1.5										66	1.32	-0.7										4.7	
Moorhead	935	54	60	28.94	29.98	-.01	42.8	+1.5	74	27	53	20	30	32	42	38	34	76	2.56	+0.3	10	8,590	se.	38	se.	4	10	10	10	5.1	5.0
Bismarck	1,674	16	29	28.18	29.98	+.01	44.0	+1.9	77	26	57	16	30	31	38	37	30	63	0.61	-1.7	7	8,445	nw.	44	se.	10	19	4	7	3.9	1.6
Williston	1,875	14	44	27.92	29.92	-.04	43.8	+1.2	81	26	57	12	29	30	47	36	28	59	0.79	-0.6	6	8,105	se.	48	nw.	27	11	9	10	5.1	2.4
Upper Miss. Valley.							51.7	+0.6										68	3.47	+0.4										5.9	
Minneapolis	.....	99	208	.....	.....	.....	45.1	-2.0	73	27	54	24	4	36	31	....	....	....	3.02	+0.2	15	11,307	n.	48	s.	27	6	11	13	....	1.5
St. Paul	837	102	122	29.02	29.94	-.05	45.7	+0.5	70	27	54	24	4	37	29	40	34	70	3.46	+1.0	16	6,691	nw.	36	nw.	2	14	3	13	5.5	1.4
La Crosse	714	71	87	29.14	29.92	-.06	48.7	+1.3	71	27	57	26	30	40	32	....	....	....	4.81	+2.6	15	8,283	n.	36	w.	6	10	9	11	5.6	0.5
Davenport	606	71	79	29.24	29.88	-.10	51.7	+2.0	78	11	61	31	30	42	32	45	39	67	3.42	+0.6	13	7,065	n.	28	w.	24	10	10	10	5.7	T.
Des Moines	861	84	99	29.00	29.93	-.04	51.2	+0.7	78	11	62	29	30	41	41	44	38	65	1.64	-1.2	9	7,809	n.	38	s.	5	6	13	11	6.1	0.5
Dubuque	698	100	117	29.16	29.92	-.06	49.6	+1.0	75	29	59	28	30	40	35	43	36	65	3.29	+0.5	15	7,251	n.	34	nw.	14	8	5	17	6.6	T.
Keokuk	614	63	78	29.23	29.89	-.09	53.5	+1.5	79	11	62	31	3	45	30	46	41	70	4.91	+1.7	11	7,114	n.	32	w.	24	10	13	7	5.1	6.1
Cairo	356	87	93	29.57	29.96	-.03	58.1	-0.8	79	9	66	37	4	50	35	51	46	68	1.85	-2.0	12	8,270	nw.	39	sw.	19	6	12	12	6.4	
Springfield, Ill	644	82	93	29.22	29.91	-.07	53.2	-0.2	84	2	63	29	3	43	35	46	41	70	3.99	+0.3	9	8,832	nw.	36	n.	3	8	12	10	5.7	1.0
Hannibal	534	75	110	29.32	29.89	-.09	54.8	+1.1	82	2	65	30	4	45	38	....	....	....	4.96	+2.2	8	8,673	sw.	38	sw.	11	6	15	9	5.9	3.3
St. Louis	567	111	210	29.30	29.91	-.07	57.4	+1.2	85	2	67	32	3	48	30	49	43	65	2.79	-1.0	14	8,383	s.	44	w.	30	9	8	13	6.1	T.
Missouri Valley.							51.5	+0.6										65	2.52	-0.4										5.0	
Columbia	784	11	84	29.09	29.92	-.06	54.9	-1.5	83	11	66	29	4	44	36	....	....	....	4.66	+1.7	13	7,598	s.	35	nw.	3	7	14	9	5.7	1.5
Kansas City	963	78	95	28.90	29.94	-.02	55.6	+1.2	83	11	65	30	3	46	33	47	40	62	2.78	-0.2	10	8,118	nw.	36	sw.	18	7	16	7	5.2	3.6
Springfield, Mo	1,324	98	104	28.53	29.93	-.04	55.9	-1.6	81	1	65	31	3	46	29	49	43	69	2.85	-1.0	9	9,781	nw.	42	sw.	10	16	7	7	4.1	0.5
Topeka	.....	81	89	.....	.....	.....	55.1	-1.7	85	11	66	29	30	44	35	....	....	....	3.08	+0.4	9	9,244	s.	38	s.	5	7	17	6	5.3	4.6
Lincoln	1,189	75	84	28.63	29.89	-.05	52.4	+1.0	81	9	64	25	30	41	40	43	36	61	3.59	+1.0	8	10,942	n.	44	n.	13	12	11	7	4.4	1.5
Omaha	1,105	115	121	28.73	29.91	-.04	52.8	+1.8	82	10	63	27	30	42	35	44	36	60	2.01	-1.1	9	9,021	n.	38	n.	3	7	12	11	5.7	0.6
Valentine	2,598	47	54	27.17	29.89	-.05	47.2	0.0	79	9	59	19	30	35	38	39	31	61	1.81	-1.0	5	9,664	n.	55	se.	17	15	8	7	4.2	0.3
Sioux City	1,135	96	164	28.70	29.92	-.03	49.3	+1.3	76	23	60	22	30	38	39	....	....	....	2.39	-0.6	9	11,525	n.	45	s.	27	9	7	14	5.9	0.5
Pierre	1,572	43	50	28.26	29.94	-.01	48.6	+2.3	82	26	60	23	30	37	40	40	32	62	1.65	-0.3	9	7,602	se.	37	se.	10	10	13	7	4.9	3.7
Huron	1,306	56	67	28.54	29.95	-.01	46.0	+1.6	75	26	59	17	30	33	40	39	32	65	1.26	-1.7	7	10,851	n.	42	s.	26	8	9	13	5.7	1.3
Yankton	1,233	42	49	28.56	29.89	-.06	49.0	+2.3	79	23	62	18	30	36	43	....	....	....	1.65	-1.4	8	7,765	nw.	35	n.	13	14	9	7	4.4	4.7
Northern Slope.							44.4	-0.2										62	1.72	0.0										5.0	
Havre	2,505	46	53	27.28	29.92	-.01	44.0	0.0	75	22	56	17	29	32	39	37	30	64	0.95	0.0	7	6,799	sw.	42	sw.	7	11	12	7	4.9	0.2
Miles City	2,371	42	50	27.38	29.90	-.06	47.6	+1.0	82	26	60	20	6	35	42	43	38	72	0.56	-0.5	5	5,600	nw.	38	se.	14	13	13	4	4.3	1.7
Helena	4,110	88	94	25.73	29.96	-.01	42.2	-1.3	71	25	52	17	29	33	35	33	23	52	1.57	+0.4	12	6,435	sw.	33	sw.	6	9	9	12	5.8	9.7
Kalispell	2,965	45	51	26.87	29.95	-.01	41.1	......	71	25	51	22	29	32	40	34	26	59	0.95	......	9	4,162	w.	30	sw.	6	10	15	5	5.1	2.2
Rapid City	3,234	46	50	26.53	29.92	-.03	45.7	-0.9	81	26	58	21	29	34	40	38	31	65	3.51	+1.2	9	6,786	nw.	34	n.	11	17	5	8	4.2	1.3
Cheyenne	6,088	56	64	23.92	29.95	+.04	40.0	-0.9	71	26	52	4	13	28	40	32	25	62	2.10	+0.7	10	8,335	nw.	48	sw.	1	7	14	9	5.6	14.3
Lander	5,372	26	36	24.55	29.93	-.01	41.4	-0.6	72	26	54	14	13	28	41	34	25	60	2.41	-0.3	11	3,703	sw.	32	sw.	26	11	12	7	4.9	16.9
North Platte	2,821	43	52	27.00	29.92	.00	49.7	+1.1	82	27	62	19	30	37	38	41	34	65	0.95	-1.2	4	7,953	nw.	36	s.	26	14	11	5	4.8	3.0
Middle Slope.							53.8	-0.4										60	1.74	-0.4										4.2	
Denver	5,291	79	151	24.64	29.90	.00	48.1	+1.2	75	23	60	18	13	36	41	38	27	52	0.81	-1.2	6	6,452	s.	48	nw.	18	9	13	8	4.7	8.5
Pueblo	4,685	80	86	25.21	29.89	+.01	50.6	+0.1	80	23	64	19	30	37	43	39	26	47	0.36	-1.1	6	6,371	nw.	44	nw.	9	11	12	7	4.7	0.1
Concordia	1,398	42	47	28.44	29.92	-.01	54.2	-1.1	85	10	66	27	30	42	37	47	43	74	3.34	+1.0	9	7,707	s.	39	s.	5	14	9	7	4.4	0.8
Dodge	2,509	44	54	27.33	29.93	+.03	53.6	-0.1	86	23	68	25	30	40	40	44	36	62	1.97	+0.4	6	11,270	se.	48	s.	4	15	6	9	4.6	1.3
Wichita	1,358	78	86	28.50	29.94	+.01	56.8	-1.0	89	1	68	30	30	45	40	49	44	69	3.31	+0.4	9	9,088	s.	37	n.	13	18	9	3	3.8	4.3
Oklahoma	1,214	79	86	28.65	29.93	+.01	59.8	-1.2	87	1	71	33	30	48	39	50	41	57	0.64	-2.0	6	11,655	s.	44	sw.	18	19	8	3	3.1	
Southern Slope.							59.8	-0.6										55	0.70	-1.5										4.9	
Abilene	1,738	45	54	28.15	29.95	+.05	64.0	-1.3	93	2	76	34	30	52	38	53	44	57	0.49	-2.2	4	7,921	se.	42	w.	2	10	13	7	5.1	
Amarillo	3,676	43	52	26.18	29.90	+.03	55.5	+0.2	85	8	69	26	30	42	49	43	33	53	0.90	-0.8	8	12,198	s.	50	w.	2	12	12	6	4.7	0.2
Southern Plateau.							56.9	-1.7										33	0.95	+0.5										2.8	
El Paso	3,762	10	110	26.40	29.82	-.01	64.6	+0.8	88	1	78	40	30	51	36	46	27	31	0.54	+0.4	1	10,326	w.	73	sw.	2	12	15	3	3.9	
Santa Fe	7,013	47	50	23.19	29.87	+.03	47.0	+0.4	68	24	58	22	13	36	31	35	21	40	0.67	0.0	6	6,169	se.	39	se.	28	14	13*	3	3.6	0.7
Flagstaff	6,907	12	25	23.27	29.85	+.01	41.0	-5.8	69	23	25	19	3	27	43	34	....	....	3.85	+2.4	7	......	sw.	....	......	...	16	8	6	3.5	4.4
Phoenix	1,108	50	56	28.71	29.86	-.01	66.3	-0.7	94	23	81	45	3	52	42	49	32	34	0.45	+0.2	1	3,345	e.	24	sw.	2	26	0	4	2.2	
Yuma	141	16	50	29.71	29.86	-.03	68.4	-1.7	97	23	83	47	15	54	43	52	34	34	T.	-0.1	0	5,072	w.	32	nw.	1	28	1	1	0.5	
Independence	3,910	51	58	25.90	29.88	-.02	54.0	-3.3	80	24	66	32	11	42	35	39	16	26	0.19	0.0	2	6,953	nw.	38	w.	10	19	7	4	3.2	0.4
Middle Plateau.							46.7	-2.8										51	0.74	-0.4										4.2	
Carson City	4,720	82	92	25.22	29.96	-.01	43.4	-4.6	72	24	56	16	2	31	37	35	27	55	0.50	-0.4	3	5,211	w.	34	sw.	9	19	8	3	2.8	4.5
Winnemucca	4,344	59	70	25.55	29.95	-.01	43.4	-3.9	74	24	56	16	11	31	36	36	27	57	0.59	-0.4	4	6,680	sw.	38	nw.	30	15	4	11	4.6	3.4
Modena	5,479	10	38	24.53	29.87	-.01	44.1	......	76	24	58	18	13	30	44	33	19	45	0.61	......	6	8,012	w.	43	sw.	1	16	9	5	3.4	1.4
Salt Lake City	4,366	105	110	25.54	29.91	-.01	48.2	-1.3	80	25	59	25	12	38	35	38	25	44	1.11	-1.1	8	5,261	se.	36	n.	4	6	17	7	5.7	0.5
Grand Junction	4,608	43	51	25.29	29.86	-.02	51.8	-1.4	79	23	64	27	13	40	34	42	34	55	0.78	+0.1	6	5,048	se.	41	sw.	1	11	14	5	4.4	
Northern Plateau.							46.7	-2.7										59	0.72	-0.6										5.7	
Baker City	3,471	53	59	26.40	30.01	+.01	42.4	-2.2	75	25	52	21	11	32	34	34	24	52	0.09	-1.1	5	5,101	se.	28	nw.	27	8	6	16	6.5	0.2
Boise	2,739	61	68	27.13	30.00	+.02	49.0	-1.9	79	25	60	24	5	38	33	39	28	51	0.69	-0.5	6	4,007	nw.	24	sw.	10	10	8	12	5.6	0.7
Lewiston	757	52	61	29.20	30.01	+.02	50.8	-2.2	81	25	62	27	5	40	38	....	....	....	0.69	-0.3	5	3,383	e.	33	nw.	3	11	11	8	4.9	
Pocatello	4,482	46	54	25.40	29.92	-.02	43.8	-3.0	76	25	54	20	2	33	36	37	30	60	1.54	0.0	8	6,658	sw.	35	sw.	4	8	16	6	5.2	9.4
Spokane	1,929	101	110	27.94	30.01	+.02	44.8	-3.2	76	25	55	26	11	34	33	37	27	57	0.40	-1.0	6	5,653	s.	40	sw.	7	3	10	17	6.9	1.2
Walla Walla	1,000	65	73	28.95	30.03	+.02	49.4	-3.9	75	24	60	31	5	39	34	45	42	77	0.89	-0.7	8	4,743	s.	30	s.	25	8	18	4	5.1	T.
N. Pac. Coast Reg.							46.8	-1.9										76	2.58	-1.6										6.8	
North Head	211	11	56	29.86	30.09	+.04	46.0	-2.0	68	28	50	33	10	42	26	43	41	84	4.15	-1.3	23	11,778	nw.	50	se.	21	3	8	19	7.6	0.9
Port Crescent	259	13	20	29.84	......	......	43.2	-1.4	59	29	50	28	10	36	24	....	....	....	1.88	-2.2	11	3,761	w.	28	w.	1	0	22	8	6.5	
Seattle	123	114	151	29.95	30.08	+.05	47.9	-2.0	65	28	55	35	11	41	26	42	37	71	1.56	-1.2	16	5,437	se.	34	se.	6	6	15	9	5.9	
Tacoma	213	113	120	29.84	30.07	+.04	46.4	-2.5	66	29	54	32	15	39	28	....	....	....	3.05	-0.4	18	4,738	sw.	28	sw.	7	0	13	17	7.4	1.0
Tatoosh Island	86	7	57	29.94	30.03	+.03	45.6	-0.5	60	28	50	33	9	41	17	43	41	86	4.40	-3.0	18	10,245	w.	55	sw.	6	6	8	16	6.5	T.
Portland, Oreg	154	68	96	29.92	30.07	+.01	49.8	-1.8	73	24	58	34	1	42	30	44	38	70	2.25	-1.0	17	4,185	nw.	30	sw.	6	4	8	18	7.0	0.2
Roseburg	518	56	67	29.53	30.09	+.02	48.4	-2.8	74	24	58	27	12	38	37	43	37	71	0.80	-1.8	14	2,847	nw.	26	sw.	16	7	10	13	6.6	0.3
Mid. Pac. Coast Reg.							53.1	-1.4										66	0.63	-1.8										3.3	
Eureka	62	62	80	29.86	30.14	+.03	48.7	-1.3	64	20	54	34	11	44	18	45	40	74	1.23	-3.0	9	7,568	n.	44	n.	4	11	10	6	4.9	T.
Mount Tamalpais	2,375	11	18	27.55	30.04	-.01	49.2	......	70	24	56	31	10	42	26	41	34	63	0.79	......	5	13,085	nw.	71	nw.	9	16	14	0	2.7	
Red Bluff	332	50	56	29.66	30.02	-.01	56.2	-3.1	81	23	68	36	10	45	34	47	38	56	0.38	-1.8	2	4,619	se.	30	n.	4	20	8	2	2.5	
Sacramento	69	106	117	29.93	30.00	-.01	56.1	-2.1	77	24	66	40	14	46	29	49	42	65	0.46	-1.8	5	6,557	s.	36	nw.	5	18	9	3	2.8	
San Francisco	155	161	167	29.90	30.07	+.02	54.0	-0.6	71	8	60	42	10	48	21	48	44	74	0.56	-1.4	3	7,729	w.	35	w.	5	18	7	5	3.2	
Point Reyes Light	490	7	50	29.49	30.00		50.4	0.0	61	21	55	41	10	46	14				0.51	-1.2	4	20,598	nw.	77	nw.	1	17	3	10	3.8	
S. Pac. Coast Reg.							57.4	-1.3										71	1.83	+0.5										3.9	
Fresno	330	67	70	29.64	30.00	+.01	57.5	-3.3	85	30	70	35	11	45	38	49	40	59	0.50	-0.8	4	3,084	nw.	20	nw.	4	21	5	4	2.6	
Los Angeles	338	116	123	29.62	29.98	-.01	58.0	-0.9	77	3	66	45	12	50	28	52	48	77	3.77	+2.4	4	3,777	nw.	20	sw.	1	9	13	8	3.6	
San Diego	87	94	102	29.88	29.96	-.03	58.4	+0.1	73	3	64	47	12	53	24	54	50	78	1.40	+0.6	6	4,860	nw.	33	sw.	17	14	7	9	4.8	
San Luis Obispo	201	46	48	29.83	30.04	-.01	55.7	-1.1	80	30	66	36	15	45	37	48	43	70	1.66	-0.3	4	4,601	w.	23	w.	10	20	7	3	2.7	
West Indies.																															
Bridgetown	30	57	65	29.88	29.92	-.03	79.2	+2.0	86	25	85	72	7	74	14	73	71	*76	1.38	+0.2	13	5,628	e.	24	e.	26	9	10	11	5.7	
Grand Turk	11	6	20	29.95	29.96	-.05	78.0	......	89	22	85	53	17	71	30	....	....	....	1.88	......	8	......	e.	....	....	....	19	9	2	3.6	
Havana	57	87	105	29.92	29.98	-.01	73.8	-2.3	87	14	80	59	25	67	21	....	....	....	0.44	-2.4	3	8,238	e.	44	ne.	28	19	11	0	2.8	
San Juan	82	48	90	29.85	29.93	-.05	78.0	......	90	16	84	69	14	72	16	72	69	75	3.07	-0.5	11	6,909	se.	29	e.	26	7	18	5	4.7	

NOTE.—The data at stations having no departures are not used in computing the district averages. * More than one date.

TABLE II.—*Climatological record of voluntary and other cooperating observers, April, 1903.*

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Alabama.					
Anniston	81	32	57.7	5.51	
Ashville	82	31	59.6	4.79	
Benton				3.16	
Bermuda	86[c]	35[c]	63.5[c]	1.35	
Birmingham	84	37	62.9	2.27	
Bridgeport				4.08	
Burkeville				2.70	
Calera				0.79	
Camphill	85	33	61.0	1.84	
Citronelle	84	39	65.6	1.38	
Clanton	80	30	58.2	2.56	
Cordova	85	30	60.8	2.81	
Daphne	85	39	65.8	T.	
Decatur	87	35	61.0	3.12	
Demopolis				1.90	
Dothan	89	41	65.2	1.67	
Eufaula	83	35	61.8	1.74	
Eutaw *	88	39	61.8	1.16	
Evergreen	83	38	62.9	3.35	
Flomaton	86	32	62.9	0.45	
Florence *a*				2.78	
Florence *b*	82	31	59.6	2.85	
Fort Deposit	84	38	62.3	2.62	
Gadsden	85	33	58.6	3.76	
Goodwater	83	33	59.2	4.39	
Greensboro	84	41	63.2	1.31	
Greenville				3.45	
Haleysville	85	34	61.4	4.72	
Hamilton	84	33	59.8	1.97	
Helena				2.07	
Highland Home	84	39	62.8	2.20	
Letohatchie				2.55	
Livingston	85	37	60.8	1.25	
Lock No. 4	84	35	59.2	3.39	
Madison Station	83	35	60.9	3.85	
Maplegrove	84	30	57.0	4.68	
Marion	83	38	62.0	1.71	
Milstead				3.94	
Newbern	87	38	62.6	1.89	
Newburg	84	30	61.0	4.95	
Notasulga				2.75	
Oneonto	79	30	58.0	5.54	
Opelika	82	36	59.0	4.73	
Ozark	85	39	63.4	2.30	
Prattville	86	35	61.2	2.39	
Pushmataha	85	33	63.0	0.25	
Riverton	84	31	58.6	2.50	
Scottsboro	83	33	57.0	3.40	
Selma	83	38	61.5	2.50	
Talladega	86	32	61.1	2.88	
Tallassee				3.30	
Thomasville	85	37	62.5	1.70	
Tuscaloosa	85	35	60.6	1.34	
Tuscumbia	83	35	59.2	2.74	
Tuskegee	84	37	63.7	3.89	
Union Springs	83	38	62.0	3.40	
Uniontown	85	37	61.8	1.92	
Valleyhead	84	32	57.5	3.95	
Verbena				1.28	
Wetumpka	84	36	62.8	2.66	
Alaska.					
Copper Center	58	−25	24.1		
Kenai	59	−17	28.2	0.67	9.5
Killisnoo	59	19	38.6	6.15	
Sitka	63	21	39.5	4.25	4.0
Skagway	60	9	39.4	0.48	4.0
Tyoonok	56	−1	32.2	1.01	17.2
Arizona.					
Agua Caliente	100	35	68.5	0.00	
Allaire Ranch				0.00	
Arizona Canal Co's Dam	94	40	66.1	0.39	
Ashfork	80	14	44.4	0.20	
Aztec	103	44	71.0	0.00	
Benson	90	31	61.8	0.00	
Bowie	85	28	53.2	0.00	
Buckeye	92	32	63.2	T.	
Champie Camp	100	34	63.4	0.40	
Cochise *[1]	100	40	60.7	0.00	
Congress	87	41	63.0	0.40	
Dudleyville	98	34	64.4	0.03	
Duncan	89	25	57.4	T.	
Fort Defiance	72	16	44.0	0.85	
Gilabend	99[c]	37	66.5[c]	0.14	
Greaterville [e]	80	33	55.8	0.00	
Jerome	82	35	57.1	0.90	T.
Maricopa	96	41	66.7	T.	
Mesa	95	42	66.0	0.34	
Mesa (near)	95	39	64.2	0.29	
Mohawk Summit *[1]	86	60	69.1	0.00	
Natural Bridge				0.65	
Nogales	88	35	60.0	0.00	
Oracle	83	38	60.8	0.00	
Oro				0.10	
Parker	102	38	67.9	0.33	
Phoenix	97	39	64.8	0.39	
Pinal Ranch				0.13	
Prescott	76	24	47.1	1.06	
San Simon	90	32	62.9	0.00	
Arizona—Cont'd.					
Sentinel *[b]	100	58	75.0	0.00	
Signal	99	35	63.3	0.61	
Superstition				0.07	
Taylor	82	25	51.0	0.18	
Tuba	85	30[d]	57.4	0.38	
Tucson	92	37	62.2	0.00	
Vail *[b]	83	53	66.8	0.00	
Walnut Grove				0.05	
Wilcox	89	29	56.6	0.00	
Yarnell				0.42	
Arkansas.					
Alco	83	35	59.2	2.78	T.
Amity	86	34	61.1	1.82	
Arkadelphia	85	31	62.3	1.55	
Arkansas City				2.34	
Batesville	85	32	60.0	2.07	
Beebranch	83	31	60.4	1.50	
Blanchard	85	32	63.0	1.56	
Brinkley	83	33	60.4	1.81	
Camden *a*				1.28	
Camden *b*	88	35	63.6	1.37	
Conway	84	32	61.1	1.18	
Corning	83	33	58.2	4.92	T.
Dallas	86	32	63.3	1.06	
Dardanelle				1.50	
Dutton	81	29	57.1	3.25	2.5
Eureka Springs	85	31	58.8	2.11	T.
Fayetteville	82	30	56.2	2.12	T.
Forrest City	83	33	61.0	1.79	
Fulton				1.04	
Hardy	81	30	59.0	2.81	
Helena *a*				1.74	
Helena *b*	84	33	61.2	1.45	
Jonesboro	84	35	60.6	1.50	
Lacrosse	84	32	58.4	2.27	
Lake Village	88	42	62.7	1.03	
Lonoke	85	33	61.6	2.18	
Lutherville	85	28	58.2	1.58	T.
Malvern	89	30	61.4	2.60	
Marianna	82	33	60.4	1.85	
Marvell	82	33	61.6	1.97	
Mossville	80	29	55.2	3.68	
Mountain Home	85	35	62.8	1.06	T.
Mount Nebo	79	33	59.0	1.59	
New Gascony	85	37	62.8	1.35	
Newport *a*				3.49	
Newport *b*	85	32	61.6		
Newport *c*	83	32	60.2	3.64	
Oregon	87	30	58.2	1.76	T.
Ozark	88	34	62.5	1.33	
Paragould	82	29	59.4	3.17	
Perry	85	33	62.4	1.05	
Pinebluff	91[c]	30[c]	63.7[c]	1.59	
Pocahontas	84	34[d]	59.5	3.02	
Pond	84	26	57.8	1.78	T.
Prescott	84	38	64.6	0.69	
Princeton	87	28	61.4	1.42	
Rison	89	27	59.8	1.85	
Rosadale	87	31	64.0	0.53	
Russellville	84	31	58.6	1.19	
Silversprings	83	30	59.0	1.25	T.
Spielerville	89	34	62.2	2.04	
Stuttgart	83	32	60.0	2.20	
Texarkana	86	33	64.6	1.25	
Warren	86	31	61.7	1.70	
Washington	88	33	63.2	0.46	
Wiggs	84	27	60.6	0.68	
Winchester	87[c]	34[c]	61.3[c]		
Winslow	80	28	56.4	1.88	T.
Witts Springs	80	31	56.1		T.
California.					
Angiola	86	27	56.6	0.22	
Azusa	86	42	61.4	4.30	
Bagdad	95	40	67.4	0.00	
Bakersfield	88	30	58.4	0.49	
Ballast Point L. H				1.20	
Barstow	89	32	58.2	0.10	
Berkeley	70	37	53.4	1.11	
Bishop	83	21	50.4	0.14	
Boca *[1]	72	18	37.1	0.70	7.0
Bodie	64	− 2	30.2	0.88	9.5
Bowman	66	18	41.8	2.54	15.5
Branscomb	73	25	46.6	1.08	
Caliente *[1]	78	43	56.7	2.42	
Calistoga	80	33	55.8	0.41	
Campbell	77	32	52.4	0.81	
Campo				3.23	
Cape Mendocino L. H				1.60	
Cedarville	70	11	41.0	0.11	2.0
Chico	83	30	56.4	0.40	
Cisco *[1]	54	18	36.2	4.20	42.0
Cloverdale	84	33	55.8	0.34	
Colusa	77	36	55.8	0.08	
Corning *[1]	78	40	55.4	0.15	
Coronado	75	46	60.6	0.86	
Crescent City	65	30	48.8	3.40	T.
Crescent City L. H				3.24	
Cuyamaca	65	25	41.2	8.21	0.8
California—Cont'd.					
Delta *[1]	82	36	51.4	0.38	
Drytown	80	32	53.6	2.20	
Dunnigan *[1]	77	47	59.0	0.12	
Durham *[b]	79	33	55.6	0.38	
East Brother L. H				0.20	
Elcajon	82	36	58.2	1.29	
Elmdale	82	32	55.4	0.15	
Elmira	83	43	62.0	0.90	
Elsinore	90	35	58.4	1.71	
Escondido	80	35	56.2	3.84	
Fallbrook	82	38	57.3	4.35	
Folsom *[1]	84	40	57.4	0.89	
Fordyce Dam				3.00	24.0
Fort Bragg				T.	
Fort Ross	68	32	50.8	0.36	
Foster				2.71	
Georgetown	73	28	49.4	2.06	2.0
Gilroy (near)	81	30	54.6	0.02	
Glendora				4.31	
Greenville	79	17	44.7	1.05	1.0
Hanford	86	35	62.3	0.50	
Healdsburg	81	30	54.4	0.39	
Hollister	79	30	54.2	0.84	
Humboldt L. H				1.31	
Idylwild				6.10	6.0
Imperial	107	50	74.4	T.	
Indio *[1]	98	53	72.6	0.75	
Iowa Hill *[1]	74	33	51.0	2.66	0.8
Irvine	82	48	61.8	4.12	
Jackson	76	32	52.2	1.31	
Jamestown	79	29	52.8	1.33	
Jolon				0.99	
Kennedy Gold Mine	74	26	45.6	1.46	
Kent	77	32	55.3	0.31	
King City	82	28	54.1	0.67	
Lakeport (near)	76	35	53.7	0.20	
Lamesa				1.75	
Laporte *[1]	66	16	39.0	2.18	11.7
Legrand	88	31	57.6	0.25	
Lemoncove	88	37	60.0	1.68	
Lick Observatory	69	26	43.7	1.12	
Lime Point L. H				0.11	
Livermore	83	30	55.4	0.81	T.
Lodi	81	33	54.6	0.23	
Los Gatos	77	36	53.6	0.78	
Lowe Observatory				4.00	
Mammoth	99	47	72.9	0.00	
Manzana	83	32	54.8	3.46	3.0
Mare Island L. H				0.60	
Meadow Valley *[1]	75	17	40.0	1.83	2.0
Merced	85	31	55.8	T.	
Mercury	84	36	58.2	0.25	
Mills College				1.14	
Milo				2.29	
Milton (near)	77	36	54.4	0.79	
Modesto *[1]	85	40	62.8	1.45	
Mohave	84	24	51.4	1.00	T.
Mokelumne Hill				1.02	
Montague	81	21	47.0	0.08	T.
Mount St. Helena				0.20	
Napa	79	35	54.6	1.13	
Needles	98	47	72.4	T.	
Nevada City	76	26	47.6	1.46	1.0
Newcastle	88	29	56.4	1.24	
Newman	81	33	57.2	0.07	
Niles	78	36	55.3	0.75	
North Bloomfield	75	24	47.6	1.91	0.8
North San Juan	80	32	53.7	1.14	
Oakland	73	39	55.6	0.55	
Ogilby *[1]	102	60	77.5	0.00	
Ontario	85	39	59.8	3.43	
Orland	83	34	56.4	0.28	
Orleans	90	30	57.7	0.84	
Palermo	82	31	55.0	0.14	
Paso Robles	84	29	52.3	0.79	
Peachland *[b]	77	32	55.3	0.37	
Piedras Blancas L. H				0.74	
Pigeon Point L. H				0.30	
Pilot Creek				1.60	8.0
Pine Crest	78	42	56.7	3.12	
Placerville	72	28	48.6	2.11	
Point Ano Nuevo L. H				0.39	
Point Arena L. H				0.65	
Point Bonita L. H				0.28	
Point Conception L. H				1.25	
Point Fermin L. H				3.20	
Point George L. H				1.52	
Point Hueneme L. H				2.56	
Point Lobos	64	41	53.0	0.67	
Point Loma L. H				0.51	
Point Montara L. H				0.10	
Point Pinos L. H				0.15	
Point Sur L. H				0.38	
Porterville	87	32	58.7	1.02	
Poway				1.95	
Quincy	74	24	45.1	0.52	T.
Redding	78	35	55.8	1.09	
Redlands	86	36	57.4	3.88	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
California—Cont'd.					
Reedley	83	35	58.2	1.26	
Represa	86	32	61.6	1.04	
Riovista	79	34	56.0	0.65	
Riverside	82	36	57.9	2.49	
Roe Island L. H.				0.25	
Rohnerville *[5]	66	29	50.2	1.05	
Rosewood	80	29	53.1	0.51	
Sacramento	80	37	56.4	0.55	
Salinas	78	32	54.0	0.17	
Salton *[1]	108	45	72.6	1.33	
San Bernardino	89	36	58.0	3.10	
San Jacinto	84	37	57.0	4.99	
San Jose	82	34	56.2	0.84	
San Leandro	76	32	54.3	0.74	
San Luis L. H.				1.33	
San Mateo *[1]	77	44	55.8	1.15	
San Miguel *[1]	82	38	56.8	0.66	
San Miguel Island	65	44	54.2	0.70	
Santa Barbara	76	40	57.0	2.91	
Santa Barbara L. H				2.59	
Santa Clara				1.99	
Santa Clara College	79	30	53.6	0.82	
Santa Cruz	78	31	53.6	0.25	
Santa Cruz L. H				0.41	
Santa Maria	89	38	57.2	0.71	
Santa Monica	72	41	54.6	2.84	
Santa Paula	85	42	64.8	2.65	
Santa Rosa	78	30	52.8	0.60	
Shasta	84	35	57.2	1.30	
Sierra Madre	79	42	57.1	4.06	
Sisson	81	22	45.7	0.13	T.
Sonoma				0.50	
S. E. Farallone L. H				0.43	
Stockton	78	39	54.8	0.33	
Storey	82	30	55.9	0.38	
Summerdale	66	23	41.8	3.37	10.0
Susanville	75	17	44.5	0.41	2.0
Tehama *[1]	80	42	60.6	0.41	
Tejon Ranch	85	33	55.6	1.42	
Trimmer				2.62	
Trinidad L. H				3.60	
Truckee *[1]	68	18	37.9	3.40	32.0
Tulare [c]	88	30	57.8	0.41	
Tustin	76	52	63.2	3.00	
Ukiah	86	27	52.4	0.01	
Upland	82	36	55.0	4.00	
Upperlake	83	25	51.6	0.20	
Upper Mattole *[1]	76	30	50.2	1.88	
Vacaville *[1]	80	41	56.0	0.01	
Visalia	86	30	57.2	0.25	
Volcano Springs *[1]	103	40	69.4	0.00	
Wasco	87	35	58.7	0.20	
Wheatland	77	34	54.4	0.49	
Williams *[1]	80	40	60.4	0.80	
Willits	80	28	49.8	0.18	
Willow	78	33	55.3	T.	
Yerba Buena L. H.				0.40	
Zenia	78	22	46.6	0.76	
Colorado.					
Alford	73	6	41.9	1.22	13.5
Ashcroft	60	−7	31.7	2.12	28.0
Blaine	89	19	51.6	1.53	5.2
Boulder	75	20	48.3	2.31	18.0
Boxelder				1.96	
Buenavista				0.80	8.0
Canyon	79	11	50.2	1.62	11.0
Castlerock	77	6	44.8	1.04	9.0
Cedaredge	80	16	47.6	1.03	
Cheesman	72	3	43.6	0.92	8.8
Cheyenne Wells	79	14	48.4	0.94	9.0
Clearview	58	2	35.6	1.85	T.
Colorado Springs	71	18	45.6	0.93	
Collbran	79	15	45.4	2.11	
Durango	75	20	45.3	2.60	7.0
Fort Collins	78	13	45.2	1.50	5.5
Fort Morgan	80	19	48.0	0.54	2.0
Fox	83	12	48.1	0.73	
Fruita	82	25	49.0	1.40	T.
Garnett	69	9	40.2	0.59	
Gilman				2.92	38.5
Gleneyre	75	10	44.8	1.15	
Glenwood	74	11	43.8	1.14	0.1
Greeley	79	21	48.0	0.56	3.0
Gunnison	70	0	38.0	2.18	15.7
Hamps	77	11	45.5	0.53	3.5
Hoehne	78	5	48.1	0.85	5.5
Holly	85	10	51.5	0.98	
Holyoke (near)	84	15	48.6	0.35	1.0
Husted	73	9	43.2	0.75	5.0
Lake Moraine	55	0	31.0	2.55	25.9
Lamar	87	20	53.8	1.44	7.0
Laporte				1.85	6.0
Las Animas	85	16	51.6	0.95	3.5
Lay				0.83	12.0
Leadville (near)				1.77	27.5
Leroy	80	13	45.4	1.12	2.2
Longs Peak	57	−4	32.1	2.55	23.0
Mancos	74	10	43.2	2.87	18.4
Colorado—Cont'd.					
Marshall Pass				1.12	19.0
Meeker	73	2	41.9	2.46	19.5
Moraine	61	12	36.4	1.42	16.0
Pagoda	76	−1	40.9	3.13	12.0
Parachute	78	20	48.4	2.14	0.5
Platte Canon				2.31	12.5
Rangely	79	12	47.4	1.00	6.0
Rockyford	85	20	52.9	0.56	
Rogers Mesa	78	18	47.2	1.19	2.3
Ruby				10.45	131.0
Russell	65	2	36.8	1.87	9.0
Saguache	75	18	42.7	0.52	
Salida	72	6	43.2	0.70	2.5
San Luis	72	5	42.2	1.25	
Santa Clara	70	0	41.0	2.58	20.3
Silt	75	16	45.0	2.34	8.0
Sugarloaf	63	6	38.4	2.00	22.0
Telluride	70	4	37.4	6.49	97.5
Trinidad	76	20	50.0	1.80	8.0
Twinlakes				0.84	11.5
Vilas				0.45	T.
Wagon Wheel	64	−3	35.4	1.17	15.0
Wallet				1.00	10.0
Waterdale	78	16	47.2	1.45	
Westcliffe	68	0	37.6	1.67	13.9
Whitepine	53	−6	27.8	2.94	39.2
Wray	84	16	49.8	0.54	2.0
Yuma				0.40	4.0
Connecticut.					
Bridgeport	86	25	49.5	3.52	T.
Canton	85	19	45.6	3.07	T.
Colchester	82	23	47.3	3.12	T.
Falls Village				2.85	0.8
Gaylordsville				2.64	2.0
Hartford	82	24	48.3	2.54	T.
Hawleyville	82	22	47.0	2.50	
Lake Konomoc				3.83	
New London	83	25	48.0	3.40	T.
North Grosvenor Dale	84	22	46.3	3.23	T.
Norwalk	87	22	48.6	3.22	
Southington	82	21	46.8	2.50	0.2
South Manchester				1.81	
Storrs	81	22	46.0	2.81	T.
Voluntown	84	20	46.5	3.67	T.
Wallingford				3.13	
Waterbury	84	22	48.4	3.38	T.
West Cornwall	81	18	45.4	3.20	1.0
West Simsbury				2.95	1.0
Winsted	83	22	46.5		
Delaware.					
Delaware City				2.29	
Milford	93	27	54.8	3.68	
Millsboro	85	27	52.8	3.46	T.
Newark	87	25	51.2	4.91	
Seaford	86	28	52.6	3.98	T.
District of Columbia.					
Distributing Reservoir *[5]	84	30	55.0	4.07	
Receiving Reservoir *[5]	82	27	54.0	4.08	
West Washington	89	24	52.8	4.98	
Florida.					
Archer	87	40	65.8	0.14	
Avon Park	88	44	69.0	0.16	
Bartow	87	45	69.8	0.60	
Bonifay	84	39	65.2		
Brooksville [k]	86	46	66.7	0.10	
Carrabelle	83	42	65.6	0.00	
Clermont	88	50	69.5	0.02	
De Funiak Springs	86	38	64.3	0.24	
Deland	87	40	65.8		
Eustis	89	46	69.4	0.44	
Federal Point	83	45	66.0	0.24	
Fernandina	82	45[c]	63.6[c]	1.44	
Flamingo	85	52	71.4	1.12	
Fort George *[1]	84	52	66.3		
Fort Meade	88	40	68.9	0.91	
Fort Myers	83	53	69.6	T.	
Fort Pierce	85	50	69.0	0.00	
Gainesville	84	44	66.4	0.37	
Grasmere	86	46	67.4		
Holt	85	37	66.4	0.00	
Huntington	88	43	67.2	0.50	
Hypoluxo	88	53	72.0	0.83	
Inverness	88	40	67.1	0.10	
Jasper	78	46	65.2	0.84	
Johnstown [d]	87	40	64.5	0.62	
Kissimmee	85	45	68.0	0.25	
Lake City	85	41	65.5	1.29	
Macclenny	89	40	65.8	1.45	
Malabar	87	48	70.0	0.09	
Manatee	89	43	68.8	0.27	
Marco	87	53	72.6	1.08	
Marianna	84	39	64.4	1.24	
Merritt Island	84	56	69.9	0.44	
Miami [h]	89	51	72.8	0.00	
Micanopy	87	43	66.7	0.90	
Middleburg	87	36	63.5	1.01	
Molino	88	35	64.4	T.	
New Smyrna	86	45	66.2	0.25	
Florida—Cont'd.					
Nocatee [1]	87	42	67.6	0.02	
Ocala	90	44	66.8	T.	
Orange City	90	39	67.4	0.35	
Orlando	89	45	69.1		
Pinemount	86	40	65.0	1.53	
Quincy	85	34	63.0	0.30	
Rockwell	89	42	67.4	0.11	
St. Andrews	85	37	64.0	0.34	
St. Augustine	86	44	65.8	0.29	
St. Leo	89	45	68.0	0.11	
Stephensville	88	39	63.4	T.	
Sumner	85	39	63.8	0.00	
Switzerland	84	44	65.4	1.22	
Tallahassee	83	42	64.2	0.11	
Tarpon Springs	86	46	67.6	0.18	
Titusville	87	46	67.3	0.43	
Waukeenah	88	40	66.0	0.06	
Wausau	88	35	65.8	0.01	
Wewahitchka	87	41	65.4	0.46	
Georgia.					
Adairsville	80[c]	34[c]	58.8[c]	2.79	
Albany	89[d]	40	60.6[c]	2.86	
Allapaha	83	40	62.6	3.64	
Alpharetta	84	28	57.6	2.03	
Americus	84	37	60.9	3.20	
Athens	80	36	58.6	2.62	
Bainbridge	84	35	63.5	0.47	
Blakely	81			1.18	
Bowersville	85	33	59.7	3.35	
Butler				6.48	
Camak	84	36	60.6	2.96	
Canton				1.47	
Carlton				2.07	
Clayton	82	25	54.9	5.25	
Columbus	85[d]	42[d]	62.0[d]	5.06	
Coney	89	34	62.8	3.76	
Covington	86	33	59.7	3.71	
Dahlonega	82	30	55.5	4.14	
Dawson	88	35	63.0	3.40	
Diamond	85	28	55.1	3.25	T.
Douglas	89[c]	36	64.4	4.74	
Dublin				3.55	
Dudley	85	39	62.4	4.37	
Eastman	86	39	62.7	2.71	
Eatonton	81	35	60.4	2.38	
Elberton	88	35	60.8	2.02	T.
Experiment	80	34	59.6	2.61	
Fitzgerald	86	35	62.6	3.36	
Fleming	89	37	64.1	2.11	
Fort Gaines	82	38	61.2	2.28	
Gainesville	81	34	56.8	2.80	
Gillsville	85	32	58.8	2.16	
Greensboro	85	33	59.4	2.73	
Griffin	83	35	60.0	2.60	
Harrison	87	39	62.6	3.51	
Hawkinsville	84	35	61.2	3.18	
Hephzibah	82[c]	38[k]	59.7[c]	2.00	
Jesup	90	39	64.2	1.61	
Lost Mountain	84	33	59.2	3.27	
Louisville	83	38	62.0	2.23	
Lumpkin	86	37	62.3	2.79	
Marshallville	82	38	61.0	5.34	
Mauzy	88	39	64.4	3.17	
Milledgeville	82	37	60.2	2.98	
Millen	92			0.57	
Monticello	86	35	60.6	2.69	
Morgan	83			3.22	
Naylor	85	42	64.4	2.98	
Newnan	85	33	58.2	2.95	
Oakdale				2.35	
Pelham		41[c]		4.30	
Point Peter	86	33	58.9	2.33	
Poulan	85	36	62.2	4.27	
Putnam	86	35	62.2	4.23	
Quitman	90	39	64.5	3.15	
Ramsey	82	29	58.5	3.51	
Resaca				3.82	
Rome	87	33	60.0	3.41	
St. Marys	85	42	64.4	1.66	
Statesboro	88	38	63.8	1.34	
Stillmore	87	35	60.8	2.02	
Talbotton	82	35	59.6	6.80	
Tallapoosa	85	31	56.2	2.62	
Thomasville	87	38	64.6	2.37	
Toccoa	86	30	57.8	6.33	
Valona	85[c]	40[c]	63.2[c]	0.98	
Vidalia	88	40	62.5	1.91	
Washington	87	37	61.0	2.90	
Waverly	85	40	64.0	1.28	
Waycross	87	42	64.7	1.32	
Waynesboro	83	38	61.4	1.53	
Westpoint	87	35	60.8	4.79	
Woodbury	84	30	58.8	3.90	
Idaho.					
Albion	80	19	43.8	0.70	4.0
American Falls	80	19	44.4	1.17	
Blackfoot	78	17	42.6	1.63	4.9
Blue Lakes	86	22	50.5	0.53	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Idaho—Cont'd.					
Burnside	70	7	37.0	1.15	5.5
Cambridge	72	22	45.0	0.47	T.
Chesterfield	74	14	38.8	1.46	6.0
Dickey	58	8	32.9	1.50	15.0
Forney	71	4	39.7	1.31	9.0
Garnet	83	25	52.1	0.69	
Grangeville	74	23	42.0	3.17	20.0
Idaho City	80	15	42.8	0.59	T.
Lake	62	−4	31.8	2.10	21.0
Lakeview	72	27	44.4	0.81	3.0
Lost River	73	15	38.8	2.13	10.0
Moscow	68	25	42.2	0.87	5.6
Murray	75	21	40.6	2.26	3.0
Oakley	72	15	44.4	1.35	5.0
Ola	80	20	47.2	0.55	
Payette	74	22	48.6	......	
Pollock	84	26	48.8	1.08	6.8
Porthill	71	23	43.0	0.83	
Priest River	74	29	41.7	1.74	
Riddle	76	8	39.3	0.79	7.0
St. Maries	80	24	44.0	1.60	0.8
Silver City	68	8	36.8	2.06	17.5
Soldier	71	8	36.8	0.53	2.5
Vernon	72	4	38.4	3.09	8.5
Weston	79	8	44.4	1.66	4.0
Illinois.					
Albion	80	24	55.1	3.18	
Aledo	88	29	52.5	3.60	T.
Alexander	85	29	54.7	3.67	1.0
Antioch	77	20	48.0	2.55	1.0
Ashton	77	23	48.1	4.62	1.0
Astoria	81	28	52.4	5.36	3.0
Aurora	79	18	49.0	4.23	T.
Beardstown	......	......	......	4.26	
Benton	85	30	57.4	3.39	
Bloomington	85	22	53.2	5.76	1.5
Cambridge	78	30	50.2	4.97	0.5
Carlinville	86	28	55.2	5.62	1.0
Carrollton	87	29	56.2	3.57	T.
Centralia	82	28	56.0	4.30	T.
Charleston	80	23	52.9	4.41	0.5
Chester	......	......	......	1.97	
Chicago Heights	......	......	......	4.32	4.0
Cisne	83	28	56.4	3.54	
Coatsburg	82	27	54.0	5.15	2.0
Cobden	81	29	56.8	3.54	
Danville	82	20	52.9	6.37	T.
Decatur	84	24	53.4	4.84	2.0
Dixon	79	28	48.8	4.20	T.
Dwight	82	22	50.4	5.14	5.0
Effingham	81	25	54.7	2.28	T.
Equality	82	30	57.5	3.53	T.
Fandon	79	29	53.2	3.87	0.6
Flora	78	26	53.8	4.79	T.
Friendgrove	79	29	54.1	4.36	T.
Galva	79	27	50.0	4.07	3.0
Grafton	......	......	......	3.40	
Greenville	84	29	55.4	4.07	
Griggsville	85	30	56.2	4.59	T.
Halfway	80	29	56.4	2.75	T.
Halliday	83	29	56.7	1.98	
Henry	80	23	52.4	5.22	T.
Hillsboro	83	28	55.2	3.57	2.0
Hoopeston	82	27	51.2	6.45	4.0
Joliet	79	18	48.4	3.62	5.0
Kishwaukee	78	24	48.6	6.00	T.
Knoxville	79	26	50.6	5.62	4.0
Lagrange	80	19	47.8	3.51	2.5
Laharpe	80	27	52.6	5.30	2.0
Lanark	78	23	48.4	4.02	2.4
Loami	......	......	......	3.85	T.
McLeansboro	80	29	56.1	3.75	
Martinsville	79	......	......	3.81	1.0
Martinton	83	25	49.2	7.18	2.0
Mascoutah	80	30	54.6	3.54	T.
Mattoon	80	26	52.6	4.16	1.0
Minonk	81	18	50.6	4.65	5.0
Monmouth	81	26	51.1	6.58	2.5
Morrison	77	27	50.4	4.45	4.5
Morrisonville	83	28	54.0	2.72	T.
Mount Carmel	......	......	......	5.82	T.
Mount Pulaski	85	27	53.7	5.10	0.8
Mount Vernon	83	29	56.9	3.66	T.
New Burnside	88	31	58.1	2.76	
Olney	80	26	54.8	4.96	T.
Ottawa	81	24	52.8	5.08	2.2
Palestine	80	24	52.8	5.41	T.
Pana	80	22	51.5	3.66	T.
Paris	80	25	52.8	4.54	
Peoria *a*	......	......	......	4.30	
Peoria *b*	81	28	54.3	5.15	
Philo	81	17	51.0	5.50	T.
Plumhill	82	29	55.4	3.13	
Pontiac	81	22	52.2	4.94	3.0
Rantoul	83	16	52.2	6.26	3.0
Raum	81	28	55.7	2.65	
Riley	76	24	48.0	3.36	1.3
Robinson	79	24	50.8	8.01	T.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Illinois—Cont'd.					
Rushville	81	30	54.4	5.63	T.
St. Charles	79	21	49.6	4.04	1.0
St. John	83	29	56.8	2.25	
Shobonier	86	28	55.9	4.36	T.
Streator	80	18	50.2	4.81	2.0
Sullivan	82	23	53.6	3.67	T.
Sycamore	80	22	50.1	4.76	T.
Tilden	81	29	56.3	3.13	T.
Tiskilwa	78	25	50.1	5.07	5.0
Tuscola	81	21	51.6	4.48	0.5
Urbana	80	19	50.8	5.71	1.5
Walnut	81	27	51.8	4.38	0.9
Winchester	85	30	54.5	4.34	T.
Winnebago	77	26	49.2	4.91	3.0
Yorkville	79	19	49.5	3.14	1.0
Zion	78	27	49.0	4.22	1.2
Indiana.					
Anderson	79	25	51.7	3.16	0.8
Angola	77	15	47.5	4.20	3.1
Auburn	82	17	47.8	4.92	T.
Avoca	82	24[e]	52.2	3.22	T.
Bloomington	81	27	53.2	4.23	T.
Bluffton	79	20	49.4	4.36	
Butlerville	82	26	53.2	4.49	
Cambridge City	79	20	49.6	3.19	T.
Columbus	80	25	53.6	3.46	
Connersville	80	22	50.6	2.74	
Crawfordsville	81	23	53.7	5.85	
Delphi	81	19	50.0	4.94	1.0
Edwardsville *[1]	80	29	57.1	7.36	
Elkhart	86	20	50.0	3.76	3.6
Farmland	79	23	49.8	3.27	
Fort Wayne	77	20	51.0	3.80	0.5
Franklin *[1]	82	30	52.5	2.66	T.
Greencastle	76	24	52.0	4.23	0.2
Greensburg	82	25	52.8	3.00	T.
Hammond	77	28	45.2	4.71	0.3
Hector	79	20	47.6	5.12	T.
Holland	83	31	55.8	3.85	T.
Jeffersonville	82	30	55.0	5.68	
Kokomo	81	23	51.8	3.91	0.5
Lafayette	79	20	50.0	4.98	1.0
Laporte	......	10	......	5.30	2.0
Logansport	82	23	50.0	4.22	
Madison *a*	84	27	55.5	4.60	
Madison *b*	......	......	......	3.97	
Marengo	82	27	54.7	5.94	
Marion	81	23	52.2	6.62	2.0
Markle	79	19	49.9	4.40	T.
Mauzy	79	23	51.0	3.21	T.
Moores Hill	80	25	53.7	3.30	
Mount Vernon	90	27	58.4	4.67	
Northfield	78	21	49.6	4.29	T.
Paoli	83	25	54.4	5.06	T.
Prairie Creek	78	23	52.9	3.89	
Princeton	80	25	54.5	4.75	
Rensselaer	78	17	50.6	5.94	5.5
Richmond	83	21	51.5	3.62	
Rockville	78	22	52.4	5.15	T.
Salem	84	25	55.5	5.65	T.
Scottsburg	82	28	54.9	4.21	4.0
Seymour	80	27	54.0	3.90	
South Bend	78	20	48.0	4.89	7.0
Syracuse	78	15	50.0	4.94	5.5
Terre Haute	83	27	53.6	4.35	T.
Topeka	76	16	48.6	3.27	0.3
Valparaiso	78	24	48.8	......	
Veedersburg	79[e]	20[e]	52.9[e]	4.40	
Vevay	78	28	55.2	4.15	
Vincennes	82	25	54.6	6.23	0.2
Washington	79	25	54.0	5.60	
Winamac	79	17	49.6	6.52	2.0
Worthington	81	32	53.0	3.79	1.0
Indian Territory.					
Ardmore	88	32	63.0	0.35	
Chickasha	90	32	61.8	0.06	
Durant	87	35	63.6	0.37	
Fairland	84	31	59.3	1.46	T.
Goodwater	86	31	61.4	0.30	
Healdton	90	29	61.8	0.32	
Holdenville	87	28	61.2	0.23	
Marlow	89	31	61.5	0.59	
Muskogee	86	32	59.1	1.27	
Ravia	87	34	64.0	0.40	
South McAlester	......	......	......	1.04	
Tahlequah	86	35	62.2	1.61	
Tulsa	......	......	......	1.25	
Webbers Falls	......	......	......	0.38	
Iowa.					
Afton	81	26	52.2	1.45	T.
Albia	80	27	52.6	2.53	
Algona	74	24	50.0	2.91	1.0
Allerton	78	26	51.5	1.80	1.0
Alta	72	22	47.2	2.65	0.7
Amana	78	27	50.8	2.39	
Ames	80	24	49.8	1.97	0.2
Atlantic	83	21	50.8	2.26	1.0
Baxter	80	24	51.4	2.12	T.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Iowa—Cont'd.					
Bedford	79	23	51.6	1.53	
Belleplaine	81	26	50.8	2.75	0.5
Bonaparte	80	28	52.6	4.15	2.0
Britt	76	22	46.6	2.69	0.3
Burlington	80	28	53.8	3.97	
Carroll	83	23	49.0	2.70	T.
Cedar Rapids	80	30	52.1	1.97	
Charles City	72	28	48.2	3.55	0.4
Clarinda	84	26	52.4	1.92	0.5
Clearlake	77	24	47.8	2.35	0.8
Clinton	82	28	51.0	4.93	1.0
College Springs	81	28	53.0	1.86	2.0
Columbus Junction	80	28	51.8	5.54	0.4
Corning	78	24	51.6	1.88	0.5
Corydon	78	24	51.9	2.44	0.5
Council Bluffs	85	25	52.5	2.72	0.4
Cumberland	......	......	......	1.65	1.0
Danville	......	......	......	3.80	
Decorah	73	27	49.1	5.38	
Delaware	73	26	48.0	4.35	T.
Denison	72[j]	21	48.4[e]	4.51	0.5
Desoto	77	28	51.6	2.39	0.5
Dows	75	22	48.0	4.04	0.2
Earlham	79	20	49.4	1.73	1.0
Eldon	80	28	51.0	2.03	2.0
Elkader	76	25	48.1	4.93	0.5
Estherville	74	23	46.4	3.04	T.
Forest City	73	23	44.9	3.33	T.
Fort Madison	......	......	......	4.81	T.
Galva	74	21	47.6	3.65	0.5
Gilman	......	......	......	3.66	T.
Grand Meadow	72	25	47.8	6.00	0.8
Greene	75	25	48.4	3.77	T.
Greenfield	78	24	50.8	2.27	0.3
Grinnell	78	26	50.4	2.04	
Grundy Center	78	23	49.3	1.69	T.
Guthrie Center	81	22	51.1	3.02	2.0
Hampton	80	25	49.0	3.62	1.1
Hanlontown	70	23	46.0	2.91	0.2
Harlan	83	24	49.8	2.32	T.
Hopeville	78	26	51.7	1.72	
Humboldt	77	22	49.2	3.49	
Idagrove	76	23	49.8	2.73	0.6
Independence	75	26	47.6	2.67	1.0
Indianola	79	27	52.2	2.38	0.2
Iowa City	80	28	51.6	3.11	
Iowa Falls	75	24	47.6	3.15	1.0
Jefferson	......	......	......	4.13	0.3
Keosauqua	80	27	53.2	4.49	
Lacona	......	......	......	2.85	T.
Lansing	75	26	50.3	4.90	3.0
Larchwood	75	17	47.4	2.12	0.5
Larrabee	72	20	47.2	2.92	0.5
Leclaire	......	......	......	3.46	T.
Lemars	73	21	48.6	2.48	T.
Lenox	80	27	52.2	1.91	0.2
Leon	79	29	53.1	1.69	
Logan	82	25	51.4	0.79	
Maple Valley	......	......	......	2.49	
Maquoketa	78	26	49.7	4.72	
Marshalltown	80	27	51.2	2.17	
Mason City	78	26	48.9	2.78	T.
Monticello	78	25	48.4	4.65	T.
Mountayr	79	27	51.6	2.11	1.0
Mount Vernon	86	26	51.4	2.97	2.0
New Hampton	71	24	47.0	3.47	T.
Newton	75	21	50.0	2.79	0.8
Northwood	71	24	47.2	3.84	T.
Odebolt	79	23	49.6	2.36	
Ogden	80	22	50.0	2.58	
Olin	77	28	50.0	3.28	0.8
Onawa	79	23	51.6	2.56	2.0
Osage	71	24	46.8	3.93	0.7
Osceola	79	27	52.8	2.12	0.5
Oskaloosa	81	24	51.4	1.67	
Pacific Junction	81	25	52.4	2.11	0.9
Perry	80	25	50.4	2.34	0.5
Plover	75	24	46.6	2.44	1.0
Primghar	72	24	47.4	2.64	......
Redoak	72	29	51.8	1.56	0.5
Ridgeway	73	25	48.2	5.68	0.8
Rockwell City	82	25	49.3	3.44	
Ruthven	74	24	47.8	3.25	
Sac City	78	25	49.2	2.55	0.8
St. Charles	80	27	52.0	3.11	0.3
Scranton	80	25	49.6	2.98	0.7
Sibley	72	19	45.6	2.28	0.6
Sigourney	82	26	52.2	2.26	T.
Sioux Center	73	20	46.6	1.72	1.0
Stockport	......	......	......	3.66	3.0
Storm Lake	73	23	48.2	3.61	T.
Stuart	79	20	50.3	1.99	
Thurman	81	23	51.6	3.49	T.
Tipton	77	30	52.5	2.76	T.
Toledo	81	25	50.4	2.73	T.
Villisca	84	23	51.4	2.75	1.0
Vinton *[1]	78	29	49.1	......	......
Wapello	79	31	53.2	3.93	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
Iowa—Cont'd					
Washington	80	23	50.3	3.79	
Washta				1.95	0.5
Waterloo	78	26	49.2	2.67	0.5
Waukee				2.04	1.0
Waverly	73	21	48.4	3.29	0.3
Westbend	77	24	48.0	3.47	0.5
Westbranch				3.77	T.
West Union				3.95	
Whitten	77	24	49.2	1.18	0.5
Wilton Junction	78	28	52.8	4.78	1.0
Woodburn				2.10	
Kansas.					
Abilene	90	28	57.4	2.32	
Achilles	87	15	50.1	1.29	3.0
Alton	85	24	54.8	2.28	2.0
Anthony				2.95	T.
Atchison	84	30	55.6	2.14	4.0
Baker	84	27	53.4	1.84	1.2
Beloit	92	26	52.4	2.61	T.
Burlington	87	30	56.2	2.92	T.
Chanute	86	32	57.8	3.29	1.5
Clay Center	86	28	55.4	3.48	
Colby	86	17	50.4	2.40	1.8
Columbus	85	31	56.4	3.80	1.7
Cottonwood	88	29	55.3	3.40	2.0
Delphos		25		4.02	
Dresden	86	19	51.8	2.70	5.0
Ellinwood	86	26	55.7	2.68	1.5
Emporia	85	29	53.7	1.85	3.0
Englewood	89	27	57.3	1.95	T.
Eureka				3.34	2.0
Eureka Ranch	86	21	52.2	3.40	5.0
Fall River	87[e]	31[e]	57.2[e]	1.76	T.
Farnsworth	96	20	52.5	4.51	4.0
Forsha	90	29	56.0	2.20	T.
Fort Leavenworth	84	30	55.9	2.50	3.0
Fort Scott	85	31	56.9	3.66	T.
Frankfort	87	27	54.8	2.31	0.5
Fredonia	87	32	57.9	2.89	0.0
Garden City	87	22	53.4	5.10	5.0
Gove *[1]	84	23	50.2	2.95	2.0
Grenola	88	29	55.6	2.56	T.
Hanover	84	26	55.9	2.50	T.
Harrison	84	22	53.4	1.98	1.0
Hays	86	21	53.0	2.01	1.0
Holton	87[e]	28	55.9[g]	3.08	6.4
Horton	85	28	54.5	2.57	1.0
Hoxie	87	17	51.6	3.35	4.0
Hutchinson	89	25	55.3	2.64	1.0
Independence	87	32	58.0	2.89	0.2
Jetmore		24		2.25	1.6
La Crosse	85	24	53.6	2.66	6.0
Lakin	89	20	53.2	5.51	5.0
Lawrence	82	30	55.8	2.53	2.2
Lebanon	83	22	53.2	2.00	2.0
Lebo	85	30	55.4	3.36	4.0
Macksville	86	24	53.6	1.40	1.0
McPherson	88	26	55.2	3.16	T.
Madison	88	29	54.8	3.23	2.0
Manhattan *b*	90	28	57.1	3.05	5.0
Manhattan *c*	85	28	55.9	2.73	2.5
Marion	84	28	56.3	2.50	3.0
Meade	99[f]	27[f]	57.5[f]	1.37[f]	
Medicine Lodge	93	28	57.8	2.00	T.
Minneapolis	85	27	54.8	3.61	0.5
Moran	83	30	56.5	3.26	2.0
Mounthope *[1]	87	30	56.0	3.58	2.0
Ness City	88	24	56.0	2.70	2.1
Newton	90	20	54.2	4.15	2.0
Norwich	89	28	57.6	3.29	1.5
Oberlin				1.30	2.0
Olathe	81	30	55.5	3.37	T.
Osage City	85	27	54.2	3.47	1.0
Oswego	84	31	57.6	2.90	T.
Ottawa	84	29	55.6	3.37	4.0
Paola				3.52	4.0
Phillipsburg				2.03	
Pittsburg	84	32	59.3	3.72	T.
Pleasanton	83	31	57.0	4.83	1.0
Pratt	90	25	55.9	1.75	T.
Republic	84	23	54.2	2.62	0.5
Rome	91	30	57.1	3.44	1.0
Russell	84	23	53.0	4.24	0.5
Salina	87	28	55.4	2.95	1.0
Sedan	86	32	57.2	2.59	0.0
Toronto	87	30	55.8	4.08	0.0
Ulysses	86[g]	21[g]	55.0[g]	2.51	6.5
Valley Falls	84	28	54.1	1.78	4.0
Viroqua	86	20	52.5	1.25	4.0
Wallace	84			1.91	8.5
Wamego *[1]	87	28	54.0	3.29	10.0
Winfield	89	30	57.6	2.91	0.5
Yates Center	88	28	57.0	2.86	5.0
Kentucky.					
Alpha	82	30	56.6	10.85	
Anchorage	82	26	53.8	6.12	
Bardstown	85	28	55.6	4.17	
Beattyville				6.55	0.5
Kentucky—Cont'd.					
Beaver Dam	84	26	54.8	2.93	
Berea	84	26	54.4	5.41	
Blandville	78	31	56.4	2.35	
Bowling Green	86	27	55.8	3.23	
Burnside	83	29	53.5	8.30	T.
Cadiz	85	30	57.8	2.34	
Carrollton	88	28	57.0	3.78	
Catlettsburg	85	25	55.2	3.79	T.
Earlington	84	28	56.6	3.38	T.
Edmonton	82[d]	27	55.0	5.35	
Eubank	85	26	54.8	6.97	
Falmouth				4.35	
Fords Ferry	83	26	56.2	2.91	
Frankfort	79	27	55.1	4.66	
Franklin	85	30	56.3	3.51	
Greensburg	85	29	54.2	4.22	
Highbridge	83	26	55.0	3.77	
Hopkinsville	83	27	55.6	2.68	
Irvington	81	31	56.0	3.61	T.
Jackson	85	28	56.6	7.33	
Leitchfield	81	28	54.7	3.93	
Loretto	81	25	55.0	4.55	
Manchester	85	27	55.9	7.64	T.
Marrowbone	87	23	55.8	5.75	
Mayfield	80	30	57.7	2.34	
Maysville	85	24	54.0	3.88	T.
Middlesboro	82	27	54.9	5.88	
Mount Sterling	82	25	53.3	3.89	T.
Owensboro	82	28	56.0	2.91	T.
Owenton	80	23	53.8	4.87	
Paducah *a*				1.86	
Paducah *b*	84	32	58.6	2.14	
Pikeville	89	22	54.2	5.41	
Princeton	84	26	56.6	2.62	
Richmond	86	26	54.8	4.07	T.
St. John	82	27	55.2	3.16	
Scott	79	24	53.2	5.14	T.
Shelby City	83	25	54.5	4.63	
Shelbyville	85	26	54.4	4.58	T.
Taylorsville	81	27	54.0	4.08	
Warfield	84	23	55.3	6.89	
Williamsburg	90	22	55.1	6.35	T.
Williamstown	80	24	53.4	3.25	
Louisiana.					
Abbeville	89	42	67.0	1.35	
Alexandria	89	40	66.4	1.42	
Amite	85	38	64.3	0.36	
Baton Rouge	87	44	66.2	0.60	
Burnside	85	40	66.0	0.62	
Calhoun	86	39	63.4	0.40	
Cameron	80	50	68.3	2.43	
Cheneyville	89	40	65.7	1.60	
Clinton	84	37	63.3	1.15	
Collinston	88	34	63.4	0.76	
Covington	90	38	66.0	0.17	
Donaldsonville	86	45	67.8	0.93	
Emilie	83	43	65.6	0.47	
Farmerville	86	34	61.0	0.74	
Franklin	87	41	67.5	1.44	
Grand Coteau	86	42	67.0	1.63	
Hammond	86	38	65.2	0.39	
Houma	88	39	66.8	0.65	
Jennings	84			1.54	
Lafayette	85	40	66.3	1.07	
Lake Charles	88	44	68.4	1.38	
Lake Providence	88	40	64.2	0.95	
Lakeside	82	48	67.4	1.79	
Lawrence	86	47	67.5		
Leesville	89	36	64.6	1.52	
Libertyhill	88	34	65.2	1.68	
Melville	83	45	65.2	1.85	
Minden	91	32	66.3	1.31	
Monroe	89			0.48	
New Iberia	83	47	68.2	1.30	
Opelousas	87	40	65.2	1.75	
Oxford	89	36	61.7	2.00	
Paincourtville	84	42	65.4	1.35	
Plain Dealing	86	32	63.0	0.69	
Port Eads	80	52	67.7	0.45	
Reserve [h]	86	42	65.3	0.20	
Robeline	88	32	63.6	2.45	
Ruston	89	32	64.4	0.60	
St. Francisville	90			1.50	
Schriever	88	40	64.6	0.45	
Sugar Experiment Station	85	44	68.1	0.85	
Sugartown	84	43	66.6	1.68	
Venice	84[d]	50[d]	67.0[d]	0.25	
Wallace	88	44	67.6	0.60	
Maine.					
Bar Harbor	76	20	42.4	3.65	3.0
Belfast	77	15	43.1	1.45	T.
Cornish	77	19	44.3	2.81	2.5
Danforth				2.55	T.
Fairfield	77	18	43.9	1.95	1.0
Farmington	76	13	43.4	2.47	4.5
Fort Fairfield	70	−1	38.6	1.25	3.0
Gardiner	78	18	44.2	1.42	0.5
Houlton	72	9	42.2	2.50	5.0
Maine—Cont'd.					
Jackman				1.51	7.0
Lewiston	76	22	44.4	2.11	0.8
Mattawamkeag				1.96	1.0
Mayfield	73	12	40.6	1.56	4.0
Millinocket	75	14	42.5	1.96	3.5
Montague				2.12	0.7
North Bridgton	79	20	44.1	2.02	3.0
Orono	76	18	43.0	1.71	0.5
Rumford Falls	75	20	43.2	1.51	1.5
South Lagrange *[1]	77	23	42.3		0.5
The Forks				1.35	2.0
Vanburen	70	0	39.4	2.25	12.2
Vanceboro	68	22	46.0	1.89	5.0
Winslow	79	16	43.4	2.21	1.0
Maryland.					
Annapolis	90			4.00	
Bachmans Valley	86	23	49.0	7.02	
Boettcherville	95	21	51.7	4.67	
Boonsboro	90	22	52.8	4.48	
Cambridge	88	29	54.4	3.20	T.
Chase	85			4.03	
Cheltenham	91	25	54.0	4.18	
Chestertown	83	27	52.3	3.28	
Chewsville	85	22	49.8	3.73	
Clearspring	88	22	50.5	4.86	
Coleman	88	26	53.0	4.91	T.
Collegepark	88	25	52.1	4.37	
Colora				3.78	
Cumberland				4.11	
Darlington	87	25	52.2	3.30	
Deerpark	82	13	45.8	3.26	1.0
Denton		25		2.57	T.
Easton	88	28	53.6	3.05	
Fallston	83	24	51.5	4.18	
Frederick	90	24	53.7	4.32	
Grantsville	83	15	47.3	4.19	T.
Greatfalls	87	25	51.3	4.07	
Greenspring Furnace	93	21	53.4	4.13	
Hancock	93	23	52.3	4.31	
Harney				5.18	
Jewell	90	25	54.1	4.41	
Johns Hopkins Hospital	91	27	54.1	4.19	
Laurel	91	25	52.9	4.82	
McDonogh	87	35	52.0	3.79	
Mount St. Marys College	85	23	51.0	6.24	
New Market	88	23	52.2	4.27	
Pocomoke City	89	29	55.8	2.80	
Prince Fredericktown	88	24	54.2	3.59	
Princess Anne	87	27	53.8	3.54	
Queenstown	86	28	53.2	3.22	
Sharpsburg	84	24	50.6	4.39	
Solomons	84	28	55.0	2.97	
Sudlersville	92	27	54.0	3.75	
Sunnyside	82	13	48.2	4.97	1.5
Takoma Park	87	23	52.2	3.91	
Van Bibber		26		4.45	
Westernport	89	21	50.8	3.27	
Woodstock	87	26	53.5	3.07	
Massachusetts.					
Amherst	84	22	46.8	2.30	T.
Bedford	84	22	46.8	3.18	T.
Bluehill (summit)	83	22	46.0	3.86	T.
Cambridge	83	22	48.4	4.07	
Chestnuthill	84	23	47.4	4.33	
Cohasset				5.40	
Concord	85	20	46.0	2.82	T.
East Templeton *[1]	81	20	44.6	2.39	T.
Fall River	82	26	47.8	4.76	
Fitchburg *a* *[1]	84	22	45.5	3.69	T.
Fitchburg *b*	85	22	46.4	2.49	T.
Framingham	83	19	47.0	2.94	
Groton	83	20	45.6	3.01	T.
Holyoke				2.57	T.
Hyannis				3.72	0.3
Jefferson				2.95	T.
Lawrence	83	21	46.5	3.42	T.
Leominster				3.05	T.
Lowell *a*	84	23	47.4	3.69	0.3
Lowell *b*	87	23	46.6		
Ludlow Center	80	15	42.0	2.73	1.0
Middleboro	82	18	45.4	4.17	
Monson	84	21	45.4	3.21	1.0
New Bedford *a*	80	25	47.0	5.77	
Pittsfield				2.04	
Plymouth *[1]	80	27	46.1	7.45	T.
Princeton				3.09	
Provincetown	78	28	46.3	4.40	T.
Salem				4.91	T.
Somerset *[1]	88	23	49.6	6.72	
Sterling				3.05	
Taunton	82	18	44.8	4.65	
Webster				2.68	
Westboro	85	20	47.8	2.86	
Weston	83	19	45.7	3.45	
Williamstown	82	19	45.2	1.37	T.
Winchendon				2.35	T.
Worcester *b*	83	22	47.3	2.28	T.

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan.	°	°	°	*Ins.*	*Ins.*
Adrian	84			4.02	T.
Agricultural College	79	13[b]	43.0[f]	......	5.0
Allegan	81[c]	16[c]	45.8[c]	2.66	3.0
Alma	80	20	45.6	2.87	T.
Ann Arbor	79	18	45.8	4.19	1.1
Annpere	78	24	43.4	1.78	3.0
Arbela	79	18	44.0	4.82	2.0
Baldwin	76	15	43.8	3.65	
Ball Mountain	80	19	45.0	5.25	1.3
Baraga	77	11	36.5	......	
Battlecreek	78	15	46.2	3.63	6.0
Bay City	85	19	44.8	4.77	T.
Benzonia	68[m]	21[m]	41.6[m]	3.14	T.
Berlin	79	16	44.5	3.03	3.0
Berrien Springs	80	19	48.2	5.00	15.0
Big Rapids	76	17	42.2	4.09	T.
Birmingham	81	18	44.4	3.83	1.0
Boon	72	13	40.6	4.93	0.8
Calumet	72	16	36.4	1.98	18.0
Carsonville	88	22	44.9	0.32	
Caseville	......	......	......	2.55	T.
Cassopolis	78	18	47.1	5.50	6.0
Charlevoix	72	22	42.0	1.96	T.
Chatham	72	12	38.6	1.84	6.5
Cheboygan	76	15	40.8	0.10	T.
Clinton	82	19	46.9	5.21	3.0
Coldwater	79	15	49.1	5.70	5.0
Deerpark	66	15	36.8	1.44	10.0
Detour	68	15	39.4	1.19	2.0
Dundee	80	20	47.3	4.29	
Eagle Harbor	75	17	37.8	2.18	5.8
East Tawas	77	17	41.4	2.19	
Eloise	80	19	46.6	4.75	2.0
Ewen	65	6	36.2	1.06	3.5
Fennville	80	21	45.8	3.94	2.0
Fitchburg	79	11	45.0	6.38	5.0
Flint	80	16	44.0	3.71	3.0
Frankfort	64	24	41.5	0.60	......
Gaylord	75	21	39.9	0.43	
Gladwin	79	17	43.6	4.00	
Grand Marais	62	18	37.2	2.48	3.5
Grand Rapids	79	22	46.4	4.80	2.5
Grape	82	20	46.0	3.92	2.0
Grayling	80[c]	11	41.4	2.50	1.5
Hagar	80	22	48.3	7.00	8.2
Harbor Beach	82	20	42.8	1.75	0.2
Harrison	......	15	......	3.83	T.
Harrisville	77	15	40.3	2.19	
Hart	62	25	43.6	1.05	
Hastings	81	11	46.2	3.72	5.0
Hayes	77	13	42.4	3.13	1.5
Highland Station	......	......	......	4.55	5.0
Hillsdale	79	14	46.2	6.17	7.0
Humboldt	72	0	33.4	0.70	7.0
Ionia	80[e]	19[e]	47.0[e]	2.20	2.0
Iron Mountain	70	15	40.4	3.26	7.5
Iron River	72	13	39.8	10.50	T.
Ironwood	73	15	40.2	0.89	3.1
Ishpeming	69	13	37.2	1.44	8.0
Ivan	77	14	42.2	3.69	0.2
Jackson	81	15	47.6	5.66	2.0
Jeddo	80	14	43.8	3.56	4.0
Kalamazoo	76[e]	15[e]	46.1[e]	4.87	10.0
Lake City	60	21	43.9	0.33	
Lansing	79	16	45.0	4.40	6.0
Lapeer	77	15	44.5	1.73	
Ludington	66	20	41.0	2.61	1.0
Mackinac Island	65	11	39.7	1.34	2.0
Mackinaw	75	18	40.4	1.56	T.
Mancelona	72	20	41.6	0.50	
Manistee	68	......	......	......	
Manistique	55	18	38.2	1.99	0.5
Menominee	72	12	39.8	1.67	T.
Midland	78	20	44.8	3.60	1.0
Mio	78	10	42.2	2.31	0.5
Montague	72	22	43.4	2.65	T.
Mount Pleasant	80	25	48.6	2.99	
Muskegon	72	24	45.9	3.26	T.
Newberry	68	24	45.0	0.12	1.0
Old Mission	72	23	42.6	3.09	0.5
Olivet	77	17	45.6	4.63	6.0
Omer	81	11	41.5	2.96	T.
Onaway	71	12	42.1	1.69	
Ontonagon	65	13	36.2	2.52	11.0
Ovid	78	16	45.0	3.22	2.0
Owosso [j]	72	10	45.5	......	
Petoskey	75	18	42.7	0.78	T.
Port Austin	80	25	43.4	0.81	
Powers	75	10	40.6	......	
Reed City	......	......	......	0.60	
Roscommon	80	12	42.0	3.03	T.
Saginaw	81	20	45.8	2.69	2.5
St. Ignace	68	28	45.0	......	
St. Johns	80	18[c]	47.0	......	
St. Joseph	77	15[d]	43.8[e]	3.85	2.0
Sidnaw	56	15	36.4	......	
Slocum	62	......	......	1.13	
Somerset	77[d]	14[e]	45.2[e]	2.93	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Michigan—Cont'd.	°	°	°	*Ins.*	*Ins.*
South Haven	75	25	47.5	3.80	1.0
Thomaston [f]	65	6	37.6	1.05	
Thornville	79	13	45.6	2.63	5.0
Traverse City	75	24	42.2	1.87	0.5
Vassar	80	17	47.1	2.40	1.0
Wasepi	79	15	47.5	5.35	4.0
Waverly	78	21	46.0	4.53	0.7
Webberville	79	15	45.1	3.57	6.0
West Branch	75	15	52.2	3.01	T.
Wetmore	65	15	35.2	1.20	7.0
Whitecloud	75	14	42.6	4.50	
Whitefish Point	59	15	35.4	1.30	1.0
Ypsilanti	80	16	44.8	4.39	1.0
Minnesota.					
Ada	75	22	43.6	1.14	1.0
Albert Lea	70	23	45.3	3.62	
Alexandria	77	18	42.7	2.94	3.0
Angus	76	13	41.2	1.26	
Ashby	77	17	44.0	3.05	
Beardsley	76	19	45.4	1.67	1.0
Beaulieu	76[d]	13[f]	39.6[e]	2.03	5.0
Bemidji	72	12	41.1	1.30	
Bird Island	74	20	45.0	2.47	......
Blooming Prairie	70	23	44.8	3.65	T.
Caledonia	71	23	45.6	5.42	0.8
Collegeville	73	21	44.7	2.71	1.8
Crookston	73	19	41.9	0.98	
Currie	74	20	45.2	......	
Deephaven	......	......	......	2.95	
Detroit	74	12	40.3	1.98	3.0
Duluth (sub station)	71	18	38.2	2.09	7.8
Faribault	72	20	44.5	3.70	0.2
Farmington	72	23	44.5	4.03	1.0
Fergus Falls	76	19	43.4	1.64	1.5
Floodwood	74	8	41.0	3.95	7.0
Glencoe	72	12	44.7	2.10	T.
Grand Meadow	75	21	45.9	4.86	1.0
Hallock	76	11	40.7	1.55	9.0
Lake Winnibigoshish	70	8	39.2	2.60	6.5
Leech	74	10	39.6	1.91	4.3
Long Prairie	76	17	43.0	3.37	5.5
Luverne	72	18	45.8	1.38	1.0
Lynd	71	18	44.2	1.68	T.
Mapleplain	74	22	45.2	3.69	1.0
Milaca	73	15	42.2	6.02	......
Milan	79	18	44.9	2.38	3.0
Minneapolis [1]	75[a]	19	44.2	3.46	1.5
Montevideo	79	15	43.4	2.70	2.0
Morris	76	17	44.6	1.93	5.5
Mount Iron	74	11	39.8	1.55	6.0
New London	74	18	42.4	2.59	2.0
New Richland	74	23	46.0	2.87	......
New Ulm	80	23	46.5	2.53	T.
Park Rapids	75	12	39.5	2.30	4.6
Pine River	75	9	40.2	4.23	8.0
Pipestone	72[d]	16[e]	42.9[d]	1.60	......
Pleasant Mounds	74	24	46.6	2.81	0.5
Pokegama Falls	74	4	39.4	2.85	9.5
Redwing *a*	......	......	......	1.70	......
Redwing *b*	73	20	46.0	4.14	T.
Reeds	......	......	......	3.64	1.0
Rolling Green	70	25	45.4	2.73	1.0
St. Cloud	75	18	44.8	3.74	T.
St. Peter	72	22	46.6	2.57	0.4
Sandy Lake Dam	73	13	40.6	2.90	9.2
Shakopee	74	21	45.8	2.85	T.
Tower	75	0	39.0	2.60	7.3
Two Harbors	67	15	37.6	3.80	4.7
Wabasha	76	24	48.9	3.63	1.0
Warroad	72	8	37.8	......	......
Winnebago	73	21	46.6	2.62	0.6
Winona	73	26	48.4	3.82	0.5
Worthington	69	20	44.0	5.26	
Wyoming	......	......	......	4.03	2.0
Zumbrota [1]	73	22	44.6	......	
Mississippi.					
Aberdeen	85	35	61.5	0.75	
Agricultural College	84	37	61.8	0.45	
Austin	83	38	62.0	2.41	
Batesville	83	33	59.7	2.36	
Bay St. Louis	85	46	67.4	0.36	
Biloxi	86	44	68.3	2.28	
Boggan	88	34	62.8	1.17	
Booneville	82	33	59.2	2.91	
Canton	86	36	63.9	0.64	
Columbus	83	36	60.2	0.62	
Crystal Springs	88	38	63.5	0.56	
Duck Hill	88	32	61.6	0.95	
Edwards	88	36	65.2	0.88	
Fayette	84	36	63.8	1.25	
Fayette (near)	......	......	......	0.83	
Greenville *a*	81	44	63.4	1.12	
Greenville *b*	85	39	63.5	1.12	
Greenwood	90	37	63.4	0.52	
Hattiesburg	90	35	66.4	1.18	
Hernando	82	41	62.0	5.98	
Holly Springs	82	35	60.4	4.60	
Indianola	90	36	63.9	1.50	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Mississippi—Cont'd.	°	°	°	*Ins.*	*Ins.*
Jackson	89	35	63.3	0.55	
Kosciusko	87	36	62.1	0.99	
Lake	84	34	60.8	0.88	
Lake Como	87	36	62.2	0.53	
Laurel	88	37	65.8	0.42	
Leakesville	91	35	64.8	0.14	
Louisville	84	35	61.8	0.90	
McNeill	86	41	65.2	0.05	
Macon	88	36	62.8	0.56	
Magnolia	88	35	63.8	0.67	
Nittayuma	86	42	64.4	1.10	
Okolona	90	35	62.1	0.15	
Patmos	......	......	......	1.23	
Pearlington	86	38	66.6	0.50	
Pittsboro	86	32	63.4	0.15	
Pontotoc	87	33	60.9	2.14	
Poplarville	87	42	66.8	0.00	
Ripley	82	30	59.2	2.95	
Shoccoe	88	35	63.0	0.71	
Stonington	......	......	......	0.20	
Suffolk	87	35	64.0	1.72	
Swartwout	86	37	65.4	T.	
Thornton	82	46	64.6	0.50	
Tupelo	84	33	60.9	2.61	
University	84	34	61.4	2.05	
Walnutgrove	90	31	64.4	0.96	
Watervalley	84	......	......	1.77	
Waynesboro	86	34	63.2	1.12	
Westpoint	86	36	62.8	1.12	
Woodville	84	41	65.3	1.13	
Yazoo City	87	43	64.5	1.55	
Missouri.					
Appleton City	83	32	56.0	4.43	T.
Arthur	83	31	56.8	4.53	T.
Avalon	82[d]	30	55.9[e]	4.87	0.4
Bagnell	......	......	......	1.84	
Bethany	80	28	53.4	3.05	2.5
Birchtree	85	34	58.6	3.77	T.
Blue Springs	83[f]	31[h]	55.0[g]	2.80	T.
Boonville	......	......	......	4.26	T.
Brunswick	83	31	54.6	5.83	T.
Carrollton	81	30	55.6[e]	5.26	2.0
Caruthersville	82	34	60.2	1.83	
Conception	81	28	53.6	1.88	0.5
Cowgill	......	......	......	2.89	1.3
Darksville	81	30	55.1	5.97	0.1
Dean	86	27	58.4	1.83	0.0
Desoto	81	32	56.1	2.29	T.
Downing	......	......	......	5.13	3.0
Edgehill	85	29	55.2	2.62	0.0
Edwards	85	30	57.1	3.46	2.0
Eightmile *[3]	......	36	55.3	4.10	1.0
Eldon	84	31	56.2	2.79	T.
Fairport	......	......	......	3.36	1.0
Fayette	82	32	56.7	4.51	3.0
Fulton	88	28	56.2	4.60	T.
Gallatin *[1]	84	32	56.4	3.54	3.0
Glasgow	82	30	55.2	3.64	T.
Gorin	......	......	......	4.37	T.
Grant City	79	29	53.2	1.81	T.
Halfway	85	31	56.8	2.24	T.
Harrisonville	83	31	54.3	3.80	3.0
Hazlehurst	......	......	......	4.44	5.0
Hermann	......	......	......	3.54	T.
Houston	85	31	57.6	2.15	T.
Huntsville	83	31	55.8	5.51	3.0
Ironton	86	29	56.4	2.94	T.
Jackson	84	30	57.4	3.18	0.0
Jefferson City	85	32	55.3	3.05	
Joplin	85	32	60.3	3.23	0.0
Kidder	82	29	54.0	2.80	5.3
Koshkonong	85	33	57.8	4.09	0.0
Lamar	84	32	58.2	3.02	T.
Lamonte	......	......	......	4.27	2.0
Lebanon	84	32	56.9	2.34	T.
Lexington	82	31	56.0	3.41	T.
Liberty	82	29	54.2	1.76	6.0
Louisiana	83	28	55.0	3.83	T.
Macon	82	30	55.6	5.47	3.0
Marblehill	84	30	57.2	3.58	0.0
Marshall	83	31	55.2	4.72	1.0
Maryville	81	28	52.5	1.65	0.2
Mexico	83	30	54.8	5.66	4.0
Miami *[5]	82	32	56.0	5.72	0.8
Mineralspring	85	31	58.2	1.55	T.
Monroe City	81	28	53.6	7.94	4.0
Montreal	84	27	56.2	1.63	T.
Mountaingrove	85	32	55.6	2.28	T.
Mount Vernon	87	30	59.2	3.03	T.
Neosho	85	29	58.5	2.17	T.
Nevada	......	......	......	3.65	T.
New Haven	89	34	58.2	2.28	T.
New Madrid *b*	......	......	......	2.25	
New Palestine	80	33	56.3	4.69	1.0
Oakfield	86	33	57.0	2.51	1.5
Olden	87	31	56.3	3.92	T.
Oregon	82	29	54.6	1.90	1.5
Palmyra *[6]	80	30	53.0	4.73	3.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Missouri—Cont'd.	°	°	°	*Ins.*	*Ins.*
Pine Hill				2.79	0.0
Poplarbluff	85	29	58.6	2.59	0.0
Princeton	80	27	52.4	2.53	4.0
Protem	91	30	60.2	2.08	0.0
Richmond				2.90	3.0
Rockport				2.12	0.2
Rolla				3.11	T.
St. Charles	86	30	57.2	2.87	T.
St. Joseph				1.32	T.
Sarcoxie				2.69	T.
Sedalia	82	30	56.4	6.13	4.0
Seymour	86	31	56.2	2.91	T.
Shelbina				6.67	T.
Sikeston	80	31	56.8	2.89	T.
Steffenville	80	30	54.7	5.22	3.0
Sublett	78	27	53.2	4.60	T.
Trenton	78	31	54.0	3.75	4.0
Unionville	76	28	52.8	3.57	2.5
Vichy	84	26	56.2	2.21	T.
Warrensburg	83	30	55.8	4.49	2.0
Warrenton	86	32	54.9	2.85	0.5
Wheatland				2.60	0.1
Willowsprings	86	29	56.2	2.74	0.0
Windsor	83	30	56.2	6.51	2.0
Zeitonia	85	29	55.8	3.24	
Montana.					
Adel	68	−9	36.6	2.62	18.0
Anaconda	72	10	40.0	0.25	4.0
Augusta	74	10	39.5	1.71	13.0
Billings	76	10	41.5		
Boulder	69	10	39.1	0.83	7.0
Bozeman	69	4	37.8	3.42	
Butte	69	13	38.7	1.30	4.0
Canyon Ferry	75	22	42.9	0.53	1.0
Chinook		17	45.0	0.67	T.
Columbia Falls	73	18	39.6	0.97	3.2
Culbertson	84	11	43.6	0.13	0.0
Crow Agency	79	17	46.4	1.15	3.0
Dayton	71	19	42.4	1.67	T.
Deerlodge	70	12	39.5		
Dillon	80	8	38.8	5.36	43.2
Ekalaka	82	18	45.3		
Fort Benton	72	18	42.6	0.65	
Fort Logan	62	20	37.4	1.34	
Glasgow	85	11	44.8	0.12	
Greatfalls	72	20	43.8	2.00	
Hamilton	77	20	44.8	0.67	3.0
Kipp[f]	70	5	38.0	0.20	2.0
Lamedeer	84	16	46.0	1.70	10.0
Lewistown	75	12	41.1	2.90	5.0
Livingston	73	2	35.6	0.10	1.0
Manhattan	73	16	42.6	2.71	12.0
Marysville	79	9	37.4	1.38	13.8
Missoula	75	25	43.6	0.65	T.
Ovando	72	12	36.6	0.75	5.0
Parrot	73	11	40.9	3.91	25.4
Poplar	84	16	46.0	0.31	T.
Redlodge	69	3	37.4	2.96	25.5
Ridgelawn	84	14	45.8	0.42	2.5
St. Pauls	71	17	42.1	1.07	1.0
St. Peter	70	0	38.2	1.84	24.0
Summit	78	−1	33.9	3.14	33.0
Toston	69	10	36.6	0.10	1.0
Townsend				0.70	
Troy	80	19	42.8	1.02	T.
Twin Bridges	72[c]	6[c]	39.4[c]	2.30	18.0
Twodot	70	10	36.4	2.90	9.0
Utica	76	12	40.6	2.29	10.0
Wibaux	75	10	41.0	T.	
Wolf Creek	75	8	41.1	1.32	19.5
Yale	80	9	39.6		
Nebraska.					
Agate	81	14	44.2	1.12	4.5
Agee *1	78	20	45.4	1.31	2.0
Albion	81	17	49.2	2.44	4.0
Alliance	80	18	47.6	0.82	T.
Alma	88	13	52.6	2.37	4.0
Ansley	82	11	47.4	1.20	3.0
Arapahoe				1.68	
Arcadia	80	14	50.2	0.92	4.0
Ashland *a*	82	24	53.4	3.88	1.0
Ashland *b*				3.88	1.0
Ashton				1.93	4.0
Auburn	86	25	55.0	2.32	0.5
Aurora	83	18	53.0	2.29	3.0
Bartley	89	12	53.2	0.80	3.0
Beatrice	82	20	52.1	3.50	2.0
Beaver	86	18	52.6	2.16	3.5
Bellevue				2.81	1.0
Benedict				2.92	
Benkleman				0.85	3.0
Blair	81	24	51.2	2.57	1.2
Bluehill				1.70	1.0
Bradshaw				2.62	
Bridgeport	84	16	47.8	0.55	
Brokenbow	81	16	49.4	0.81	3.5
Burchard				2.08	
Burwell				2.17	4.0
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Callaway	80	13	44.9	2.05	4.0
Cedar Rapids	79	17	46.2	2.99	3.0
Central City				1.55	3.0
Chester				2.90	T.
Columbus	80	20	50.8	2.98	1.2
Crete	84	23	53.0	2.91	1.1
Culbertson				0.90	0.8
Curtis	84[g]	19[g]	51.8[g]	1.10	5.0
David City	80	20	50.7	3.17	1.2
Dawson	87	27	54.0	2.41	0.5
Edgar				2.00	2.0
Ericson				2.40	5.0
Ewing				2.50	2.5
Fairbury	84	23	51.9	3.17	2.0
Fairmont	82	20	51.0	1.89	1.0
Fort Robinson	89	9	47.5	1.21	4.0
Franklin[f]	85	15	51.2	2.57	1.0
Fremont	79	24	49.9	2.64	1.5
Geneva	88	20	50.9	2.76	3.0
Genoa (near)	80	20	51.0	2.66	1.5
Gering	82	16	49.0	1.42	
Gordon				1.30	1.0
Gosper				0.94	1.2
Gothenburg	86	10	48.2	0.92	
Grand Island *b*	84	17	49.8	1.86	1.6
Greeley				1.75	2.0
Guide Rock				1.69	2.0
Halsey	83	12	50.8	1.68	1.6
Hartington	78	17	46.9	1.90	2.5
Harvard	82	18	51.0	1.98	1.0
Hastings *1	82	20	51.2	1.45	2.0
Hayes Center				1.42	10.0
Hebron	83	23	53.4	2.73	1.0
Hickman				3.67	0.5
Holbrook				1.24	5.0
Holdrege				1.83	3.0
Hooper *1	78	26	50.4	2.36	1.0
Imperial	81	14	48.4	0.70	4.0
Johnstown				1.57	1.0
Kearney				1.78	2.0
Kennedy	83	16	47.0	1.65	2.5
Kimball	80	10	44.4	1.25	5.0
Kirkwood	80	10	50.4	2.04	3.0
Leavitt	82	20	49.8	2.12	3.0
Lexington	82	10	48.2	1.15	3.0
Lockridge	83	19	51.6	2.50	2.0
Lodgepole	83	16	47.0	0.97	1.2
Loup	82	13	49.4	1.18	4.0
Lynch				1.20	3.0
Lyons				2.27	1.0
McCook				0.90	2.5
McCool Junction				2.72	
Madison	78	18	48.8	3.00	2.0
Madrid	82	17	48.0		
Marquette				1.63	
Mason				1.40	
Minden *b*	83	16	50.4	1.83	2.0
Monroe				3.55	2.0
Nebraska City *c*	84	25	55.1	2.30	T.
Nemaha				1.84	1.0
Norfolk	80	18	48.8	3.52	1.2
North Loup	83	17	50.6	1.95	4.5
Oakdale	80	14	48.2	2.24	3.0
Odell				2.65	
O'Neill	85	13	46.9	1.30	3.0
Ord				1.84	
Osceola				2.97	
Palmer				2.25	2.0
Palmyra *1	82	22	51.6	4.05	
Pawnee City				2.46	0.5
Plattsmouth *a*				2.04	2.0
Plattsmouth *b*	83	27	52.4	1.84	2.0
Purdum	81	12	48.1	2.23	3.0
Ravenna *a*	81	15	50.1	1.45	2.5
Ravenna *b*				1.62	2.0
Redcloud	87	21	51.8	1.85	2.0
Rulo				1.53	
St. Libory				2.06	3.0
St. Paul	83	16	52.6	2.16	2.0
Salem				1.20	0.5
Santee	82	16	51.4	1.26	2.3
Schuyler				3.32	2.0
Seward	84	23	53.7	3.86	1.0
Smithfield				1.68	5.0
Spragg				1.91	3.0
Springview	81	17	49.7	1.55	
Stanton	79	19	50.2	2.78	
Strang				2.48	1.0
Stratton				0.80	3.0
Superior	80	22	51.9	1.70	2.0
Syracuse				1.90	1.0
Tablerock				3.10	1.0
Tecumseh *b*	82	24	52.8	3.17	
Tecumseh *c*				3.13	0.5
Tekamah	81	24	52.4	3.57	4.0
Turlington	82	25	53.0	2.44	1.0
University Farm	84	25	53.2	3.41	2.0
Wakefield	78	20	49.2	2.56	0.5
Nebraska—Cont'd.	°	°	°	*Ins.*	*Ins.*
Wallace				0.30	3.0
Wauneta				0.39	2.2
Weeping Water				2.01	1.0
Westpoint	79	21	53.1	1.68	2.0
Wilber *1	82	26	53.9	4.17	2.0
Willard				0.65	1.0
Wilsonville				2.15	3.0
Winnebago	78	21	49.8	1.96	2.0
Wisner				2.04	2.0
Wymore	82	28	53.6	2.83	T.
York	83	20	53.8	2.70	2.0
Nevada.					
Amos	75	10	39.8	0.33	
Austin	68	16	41.4	1.91	
Battle Mountain	78	15	46.2	0.30	
Belmont	69[c]	14[c]	40.9[c]	0.26	2.0
Beowawe	82	24	49.2	0.00	
Caliente	88	19	51.0	0.10	
Candelaria	75[c]	19[d]	45.7[c]	0.12	0.7
Carson City	76	18	43.8	0.19	0.5
Cranes Ranch				0.82	
Dyer	80	14	44.9	0.01	
Elko	69	15	43.5	0.50	
Ely	75	12[j]	41.5[c]	1.16	6.0
Eureka	74	12	43.0	1.10	15.0
Fenelon *1	80	17	42.4		
Halleck *5	74	24	42.4		0.5
Hamilton	60	8	33.2		2.5
Hawthorne	78	19	46.9	0.10	
Humboldt	76	25	47.6	0.13	
Lewers Ranch	76	18	44.2	1.08	4.5
Lovelocks	70	26	49.3	0.78	
Martins	85	12	45.6	0.53	2.0
Mill City *1	74	20	47.6	0.00	
Monitor Mill	71	1	37.0	1.10	12.0
Palisade	91	22	46.5	0.00	
Palmetto	76	15	43.2	1.38	10.0
Potts	75	10	39.0	0.90	8.0
Reno State University	74	19	43.7	1.04	0.6
Rioville	101	37	66.6	0.05	
Silverpeak	82	26	49.8		
Sodaville	86	21	50.2	T.	
Tecoma	78	15	43.6	T.	
Toano *5	82	23	43.4	0.20	2.0
Wabuska	78	17	46.7	0.05	
Wadsworth	81	18	47.8	0.00	
Wells *1	82	22	49.5	0.00	
Wood	76	11	41.8	1.02	
New Hampshire.					
Alstead	81	17	43.4	2.27	1.8
Berlin Mills	79	6	40.2	1.34	5.1
Bethlehem	78	10	40.8	1.36	6.0
Brookline *1	86	18	45.8	3.58	0.2
Chatham	78	12	41.4	1.30	4.0
Concord	85	17	44.3	1.65	T.
Durham	80	18	44.8	2.34	
Franklin Falls	82	17	42.9	1.72	0.2
Grafton	85	12	41.8	1.89	2.0
Hanover	86	14	44.2	0.97	1.9
Keene	87	16	44.3	2.13	0.5
Littleton	80	8	40.2	1.47	14.0
Manchester				1.94	T.
Nashua	87	19	45.6	2.92	T.
Newton	81	14	45.4	3.50	T.
North Stratford				T.	T.
Plymouth	82	17	43.4	1.33	T.
Sanbornton	81	17	42.6	1.48	T.
Stratford	82	7	40.9	1.12	4.0
West Stewartstown				1.58	3.5
New Jersey.					
Asbury Park	85	27	50.0	3.22	T.
Barnegat	89	23	50.9	4.02	T.
Bayonne	89	27	51.6	2.86	T.
Belvidere	89	24	51.2	4.27	
Bergen Point	89	27	51.0	3.80	
Beverly	92	27	52.4	4.73	T.
Blairstown	87	23	50.2	3.90	
Bridgeton	91	26	53.4	5.05	
Camden	89	27	53.4	3.92	
Canton				3.33	
Cape May C. H.	85	27	51.4	2.68	T.
Charlotteburg	86	18	47.6	4.42	
Chester	86	22	48.4	4.80	
Clayton	89	26	51.3	3.53	
College Farm	90	26	50.6	4.57	
Dover	90	23	48.2	4.34	
Elizabeth	90	25	52.7	3.66	T.
Essex Fells[d]	88	24	51.4		
Flemington	87	26	50.9	4.45	
Freehold	88	27	50.6	3.81	T.
Friesburg	87	26	51.4	4.00	
Hightstown	90	27	51.8	7.03	
Imlaystown	88	26	52.2	4.58	T.
Indian Mills	91	24	51.6	3.33	T.
Lakewood	91	24	50.2	3.46	
Lambertville	89	26	51.4	4.56	T.
Layton	87	18	47.6	2.94	
Moorestown	90	28	51.6	5.33	T.

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
New Jersey—Cont'd.					
Mount Pleasant				3.55	T.
Newark	89	26	51.0	3.13	
New Brunswick	91	26	52.2	4.53	T.
Newton	83	23	49.2	3.05	
Oceanic	84	29	50.5	2.59	0.2
Paterson	92	27	53.0	4.51	T.
Pemberton	90	26	51.3	4.80	
Perth Amboy	90	29	52.5	3.91	
Phillipsburg	88	26	50.6	4.16	T.
Plainfield	89	26	50.4	4.05	T.
Rancocas				4.10	T.
Ringwood	89	20	48.8	3.78	
Rivervale	87	22	49.0	5.13	
Salem	90	25	52.4	3.61	
Somerville	88	25	50.4	4.01	T.
South Orange	85	26	50.2	3.67	T.
Sussex	87	23	49.2	3.71	T.
Toms River	91	22	49.8	3.66	T.
Trenton	89	30	54.7	6.49	
Tuckerton	88	27	50.8	4.19	T.
Vineland	90	26	52.0	4.66	T.
Woodbine	88	24	51.0	3.35	T.
Woodstown				3.17	
New Mexico.					
Alamagordo	89	30	59.8	T.	
Albert	84	26	55.7	0.81	T.
Albuquerque	82	26	56.5	0.05	
Alma	85	23	54.2	T.	
Arabella	82	24	56.0	0.00	
Bellranch				0.74	T.
Cambray				T.	
Carlsbad	94	33	65.1	0.51	
Cloudcroft	62	18	41.1	0.15	
Deming				0.00	
Dorsey	78	18	47.7	0.98	
Eagle Rock Ranch	71	15	47.0	1.86	7.5
Engle	82	31	55.8	0.27	
Fort Stanton	75[e]	18	50.8[e]	0.20	
Fort Union	76	18	45.9	0.54	T.
Gage				0.00	
Galisteo	74	28	53.0	0.12	
Gallinas Spring	81	30	53.4	1.15	
Golden				0.15	1.5
Hot Springs	73	18	47.6	0.31	
Las Vegas	78	18	48.6	0.52	1.0
Lordsburg				0.00	
Los Lunas	88	30	57.0	T.	
Luna	78	10	45.8	T.	T.
Mesilla Park	89	34	60.6	0.08	
Mountainair	84	17	49.8	0.43	T.
Raton	90	18	48.8	0.00	
Roswell	89			T.	
San Marcial	93	35	61.3	T.	
Strauss				0.45	
Taos	74	23	46.5	1.58	
Winsors	67	10	39.5	1.88	
New York.					
Adams				2.59	2.0
Addison	84	20	45.2	2.67	T.
Adirondack Lodge	80	7	37.4	2.72	7.1
Akron				4.30	
Alden	81	18	45.8	4.02	0.5
Amsterdam				1.49	T.
Angelica	85	14	44.6	2.65	T.
Appleton	83	24	45.0	3.52	T.
Arcade	80	15	42.0	4.13	4.0
Athens	86	23	48.8	1.96	T.
Atlanta	83	17	43.4	2.92	2.0
Auburn	86	20	46.8	3.09	T.
Avon	83	20	44.2	3.33	T.
Axton	74	9	37.0	1.95	2.0
Baldwinsville	85	22	45.6	2.18	T.
Beaver	82	11	39.8	1.56	1.0
Bedford	85	23	49.6	1.91	T.
Berlin	84	18	45.3	1.49	1.0
Blue Mountain Lake				1.85	T.
Bolivar	81	14	42.8	2.47	T.
Bouckville	82	15	43.2	1.80	
Boyds Corner				2.68	
Brockport	83	19	45.4	3.70	1.0
Brown Station				1.62	
Caldwell	86	18	45.3	1.69	2.0
Canajoharie	87	18	44.9	1.27	T.
Canaan Four Corners	85[d]	17[d]	45.0[d]	2.05	
Carmel	84	23	49.0	2.63	T.
Carvers Falls	86	19	43.8	0.78	
Cedarhill	86	22	47.4	0.96	5.0
Chazy	82	12	44.2	2.48	1.0
Cooperstown	82	17	42.6	1.57	T.
Cortland	84	10	45.1	1.12	
Cutchogue	80	27	48.0	4.26	T.
Dekalb Junction				2.85	2.0
De Ruyter	78	16	42.4	1.60	1.0
Easton				1.45	3.0
Elba	80	18	42.4	3.15	T.
Elmira	88	22	47.7	2.24	
Fayetteville	86	20	45.6	2.36	T.
Franklinville	79	15	42.5	3.49	0.5

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
New York—Cont'd.					
Gabriels	82	7	37.9	2.57	1.5
Gansevoort				2.13	3.0
Glens Falls	84	19	46.0	1.27	2.0
Gloversville	89	17	44.2	1.37	
Greenwich	85	19	45.8	0.95	2.0
Griffin Corners	82	13	42.0	2.17	T.
Harkness	87	15	44.4	2.37	0.5
Haskinville				2.16	
Hemlock	76	21	45.3	2.60	
Homer	83	19	43.2	1.25	T.
Honeymead Brook	85	23	46.6	2.02	1.0
Indian Lake	81	10	39.1	2.16	T.
Ithaca	84	21	44.6	1.04	1.5
Jamestown	82	17	45.4	3.73	T.
Keene Valley	86	13	41.6	2.37	0.5
King Ferry				1.39	T.
Liberty	83	14	43.5	2.26	T.
Littlefalls, City Res.	87	22	45.2	1.44	T.
Lockport	80[c]	19[c]	44.7[c]	4.00	0.5
Lowville	82	15	41.6	2.87	
Lyndonville				3.05	
Lyons	85	21	47.6	2.83	T.
Middletown	84	23	47.4	3.59	T.
Mohonk Lake	81	19	46.4	3.03	1.0
Moira	84	10	44.2	2.61	0.2
Mount Etrick	81	16	43.4	1.82	
Newark Valley				1.62	
New Lisbon	83	14	41.2	1.26	T.
North Hammond				3.41	2.0
North Lake				1.12	T.
Number Four	81	9	40.8	2.46	1.6
Nunda	83	18	44.6	3.63	T.
Ogdensburg	80	11	43.2	1.80	11.2
Oneonta	86	15	44.8	1.05	T.
Oswegatchie	66[c]	11[c]	40.9[c]	2.39	T.
Otto	84	14	44.0	3.23	
Oxford	82	18	44.0	1.69	T.
Palermo				3.03	
Penn Yan	84	20	45.5	2.11	T.
Perry City	82	16	43.2	1.86	T.
Plattsburg	88	11	41.2	1.70	T.
Port Jervis	88	22	48.6	3.52	T.
Primrose	87	23	48.8	5.66	
Redhook				2.63	
Richmondville	86	15	44.6	1.03	T.
Ridgeway	80	21	44.2	3.66	2.1
Rome	86	20	45.8	3.30	
Romulus	85	21	46.2	2.77	T.
Salisbury Mills				3.70	4.5
Saranac Lake	83	6	40.3	2.23	0.4
Scottsville				3.15	
Setauket	80	28	48.7	3.61	0.3
Shortsville	84	21	45.2	2.29	0.5
Skaneateles				2.77	
Southampton	80	26	47.2	4.19	T.
South Butler	80	22	43.5	3.37	0.5
South Canisteo	81	15	42.0	3.24	1.5
Southeast Reservoir				2.69	
South Kortright	84	12	42.4	1.71	0.1
South Schroon	83	11	42.1	1.94	1.3
Speer Falls	87	18	45.8	1.13	T.
Straits Corners	84[f]	18[f]	43.6[f]	2.27	0.5
Ticonderoga	82	18	45.5	1.64	0.1
Volusia	76	14	45.1	3.10	
Walton	84	18	44.0	2.05	0.6
Wappinger Falls	87	23	48.8	3.19	1.0
Warwick				3.50	
Watertown	82	12	43.9	2.70	1.0
Waverly	86	20	45.7	2.25	T.
Wedgwood	80	17	43.0	2.06	T.
Wells	84	16	42.5	1.71	
West Berne	85	15	43.4	1.46	
Westfield *b*	79	19	44.9	3.09	
Westfield *c*				3.14	T.
Windham	87	16	43.2	2.65	T.
Youngstown				3.83	
North Carolina.					
Bryson City				8.61	
Chapelhill	86	29	59.2	7.99	
Currituck				3.98	
Edenton	87	31	58.9	4.59	
Fayetteville	87	30	60.6	3.39	
Flatrock	83	26	54.6	4.63	T.
Goldsboro	84	30	58.0	3.64	
Graham				6.09	
Greensboro	87	29	56.5	5.32	
Henderson	84	29	57.9	4.87	
Hendersonville	85	27	54.6	4.38	
Henrietta	87	29	57.4	4.10	
Highlands	71	15	46.6	7.80	
Horse Cove	77	26	52.4	5.34	T.
Jefferson	81	23	50.4	3.49	T.
Kinston	86	30	56.7	2.99	
Lenoir	82	19	53.8	5.36	
Lexington	85	29	58.1	6.83	
Linville	77	15	44.2		
Littleton	85	27	56.3	6.07	
Louisburg	85	30	58.0	7.06	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	Ins.	Ins.
North Carolina—Cont'd.					
Lumberton	82	34	59.4	3.64	
Marion	86	28	56.8	5.17	T.
Marshall	82	24	51.6	6.14	0.2
Mocksville	88	28[c]	54.4[b]	5.19	
Moncure	88	29	58.2	4.90	
Monroe	85	26	57.0	3.32	
Morganton	86	26	56.8	4.85	
Mountairy	83	27[c]	58.1	4.04	
Murphy				4.92	T.
Newbern	85	32	60.1	3.97	
Patterson *[1]	80	26	52.1	5.28	T.
Pittsboro	88	29	58.4	6.08	
Reidsville	85	26	56.8	5.01	
Rockingham	89	31	60.0	5.12	
Roxboro	87	26[c]	57.0	6.51	
Salem	83	26	56.8	3.98	
Salisbury	85	29	59.4	5.10	
Saxon	86	25	55.3	4.70	
Selma	87	29	58.4	7.19	
Settle	86	30	58.1	5.19	
Sloan	85	31	59.4	3.27	
Soapstone Mount	84	26	56.2	5.93	
Southern Pines *a*	89	29	60.8	4.87	
Southern Pines *b*	87	31	60.4	4.09	
Southport	81	34	61.6	2.40	
Springhope	86	31	58.8	7.78	
Statesville	84	26	56.2	7.37	
Tarboro	90	32	59.4	4.39	
Washington	91	31	61.7	3.70	
Waynesville	83	27	54.8	4.69	
Weldon *a*	82	30	56.6	5.89	
Weldon *b*				6.07	
North Dakota.					
Amenia	76	15	42.5	1.63	1.0
Ashley	73[d]	11[d]	39.6[d]	1.21	3.0
Berlin	72	8	41.4	3.65	23.0
Bottineau	75	14	42.0	T.	
Buxton	74	17	42.6	0.84	2.0
Cando	76	13	41.2	0.55	
Churchs Ferry	73	17	41.0	1.72	1.0
Coalharbor	77	15	44.4	T.	T.
Devils Lake	72	18	41.6	2.18	3.0
Dickinson	80	15	46.0	0.31	2.0
Donnybrook				1.30	2.0
Dunseith	82	13	42.2	0.40	2.3
Edgeley	74	16	44.0	2.85	2.0
Elbowoods	75	17	42.4	0.30	3.0
Ellendale	78	22	44.8	1.55	1.0
Fargo	76	14	42.7	1.34	
Forman	75	15	43.2	2.22	7.0
Fort Yates	76	20	46.4	1.00	
Fullerton	74	15	42.8	3.04	14.2
Gallatin	68	10	39.2	1.21	5.5
Glenullin	77	17	44.5	0.47	3.5
Grafton	73	17	41.0	0.56	0.6
Hamilton	72	14	40.8	2.38	7.0
Jamestown	77	16	44.1	1.33	1.0
Larimore	74	16	40.5	0.89	2.2
Libson	76	12	41.6	1.96	T.
McKinney	75	10	40.0	0.50	
Mayville	75	8	40.6	0.05	T.
Medora	83	16	45.4	0.15	1.5
Melville	72	17	43.0	1.46	T.
Minnewaukon	72	17	43.0	1.70	
Minto	74	11	39.8	0.88	T.
Napoleon	77	18	44.2	1.27	5.0
New England	76	10	41.8	0.55	0.5
Oakdale	79	16	44.6	0.58	4.0
Pembina	72	10	39.8	1.41	6.2
Portal	72	16	40.2	1.25	2.0
Power	77	16	42.7	1.34	2.5
Steele	74	13	42.1	0.70	6.0
University	72	18	43.8	0.75	
Wahpeton	79	18	45.6	2.55	
Willow City	76	12	41.4	0.53	
Woodbridge	75	13	40.6	0.51	5.1
Ohio.					
Akron	80	20	48.4	3.86	0.5
Atwater				4.37	
Bangorville	80	19	49.7	4.57	T.
Bellefontaine	78	19	48.1	3.30	T.
Bement				3.78	T.
Benton Ridge	80	22	50.0	5.95	0.5
Bladensburg	80	16	48.3	4.56	
Bloomingburg				3.60	T.
Bowling Green	81	19	48.4	5.26	1.0
Bucyrus	77	18	51.8	4.98	T.
Cambridge	83	19	51.2	5.34	
Camp Dennison	82	22	53.2	3.13	T.
Canal Dover	82	18	48.6	3.20	T.
Canton	81	20	48.8	3.99	0.1
Cardington	80	19	48.8	3.69	0.3
Cedarville				3.46	
Centerburg				3.85	T.
Chillicothe	85	22	52.6	4.28	
Circleville	81	22	52.0	3.63	T.
Clarington	82	21	51.8	4.70	
Clarksville	80	24	52.6	3.21	T.

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Ohio—Cont'd.					
Cleveland *a*	80	22	48.4	4.25	1.0
Cleveland *b*	81	20	48.0	3.86	T.
Clifton	78	23	51.0	3.35	
Coalton	84	19	52.5	3.21	
Colebrook	80	17[c]	46.6[c]	4.19	
Coshocton				5.26	
Dayton *a*				3.03	
Dayton *b*	80	22	51.2	3.66	
Defiance	82	19	48.3	4.55	0.5
Delaware	81	20	49.9	3.41	0.1
Demos	81	12	50.8	4.03	T.
Dunham				3.82	
Elyria	83	21	47.8	3.95	
Findlay	83	22	49.8	5.50	
Fort Recovery				4.96	
Frankfort	81	23	52.2	3.11	
Fremont	83	21	49.8	4.80	1.0
Garrettsville	81	14	47.1	4.69	2.5
Granville	79	20	50.6	3.94	T.
Gratiot	80	19	50.3	3.66	0.1
Green	83	24	52.6	4.77	T.
Greenfield	80	26	53.1	3.90	T.
Greenhill	79	14	46.7	2.34	0.2
Greenville	80	22	50.4	3.43	
Hanging Rock	86	22	55.0	4.83	
Hedges	81	20	49.6	5.87	
Hillhouse	80	10	45.3	4.39	2.0
Hiram	79	11	47.9	4.79	2.0
Hudson	82	12	46.8	4.10	3.0
Jacksonboro	81	22	50.9	2.87	
Kenton	79	20	50.0	4.05	T.
Killbuck	79	12	49.0	3.61	T.
Lancaster	81	21	51.4	3.16	T.
Lima	79	20	48.8	6.48	T.
McConnelsville	84	19	50.6	4.13	T.
McCormick				4.85	
Manara	77	22	50.4	3.47	
Mansfield				4.50	
Marietta	82	24	54.2	4.20	
Marion	83	19	50.6	3.51	T.
Medina	81	16	48.4	4.51	1.0
Milfordton	76	19	48.0	4.16	T.
Milligan	82	18	51.1	2.76	
Millport	80	16	47.5	2.64	T.
Montpelier	79	18	47.2	5.86	2.5
Morrow				3.65	
Napoleon	80	20	49.2	4.47	T.
New Alexandria	82	19	51.4	3.40	T.
New Berlin	80	15	48.5	4.33	T.
New Bremen	79	21	49.2	5.43	
New Lexington				3.30	
New Richmond	82	25	54.1	3.88	0.2
New Waterford	85	15	48.8	2.87	T.
North Lewisburg	80	19	50.6	3.25	
North Royalton	76	16	47.5	5.30	1.0
Norwalk	83	21	48.6	4.18	2.0
Oberlin	82	19	48.6	5.63	
Ohio State University	79	21	50.2	2.63	
Orangeville	81	15	47.0	4.28	T.
Ottawa	84	20	50.0	5.65	
Pataskala	79	19	49.8	3.79	T.
Philo	82	21	52.4	4.08	
Plattsburg	79	21	50.2	2.98	T.
Pomeroy	84	28	52.0	4.15	
Portsmouth *a*				3.69	T.
Portsmouth *b*	88	26	55.5	4.19	T.
Pulse	80	24	53.0	3.10	T.
Redlion				2.66	
Richfield				4.74	1.0
Ripley	80	22	52.0	3.65	T.
Rittman	82	18	48.2	5.10	T.
Rockyridge	82	21	47.9	4.37	T.
Shenandoah	79	20	47.9	5.45	0.8
Sidney	82	22	51.8	2.97	0.3
Somerset	82	21	51.6		T.
Springfield				2.78	
Strongsville				6.63	0.5
Thurman	85	20	53.6	4.02	
Tiffin	80	22	49.8	6.19	0.7
Upper Sandusky	83	21	51.3	4.60	
Urbana	76	20	48.2	2.54	T.
Vickery	80	23	48.1	4.79	0.3
Wadsworth				4.35	
Walnut				3.77	T.
Warren	82	18	48.0	2.59	0.3
Warsaw	80	16	48.2	4.45	
Wauseon	82	19	48.4	5.41	1.3
Waverly	84	21	53.6	3.64	T.
Waynesville	79	23	51.3	2.98	
Wellington	83	20	48.8	5.46	1.0
Willoughby				4.42	
Wooster	74	19	48.6	4.55	0.5
Zanesville				2.98	
Oklahoma.					
Arapaho	90	29	60.0	1.19	
Beaver	89	28	55.8	1.67	1.0
Blackburn	91	31	59.0	2.78	
Burnett	90	31	62.1	0.11	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Oklahoma—Cont'd.					
Chandler	88	33	59.8	0.80	
Cleo	95	27	59.2	1.45	
Clifton	89	30	60.2	0.38	
Cloud Chief	89	30	58.3	3.40	
Enid	91	33	58.5	2.51	T.
Fort Reno	92	30	61.2	2.30	
Fort Sill	86	30	61.2	0.20	
Guthrie	98	34	62.0	2.23	
Hennessey	92	31	60.2	1.45	
Hobart				2.86	
Jefferson	93	32	58.4	2.70	
Jenkins	88	30	58.2	3.52	
Kenton	86	20	53.2	0.85	4.0
Kingfisher	86	31	59.8	0.58	
Mangum	90	35	62.4	2.60	
Newkirk	85	32	59.2	2.21	
Norman	91	32	60.8	0.25	
Okeene				1.51	
Pawhuska	89	33	60.0	2.00	
Perry	91	30	59.2	0.73	
Sac and Fox Agency	89	33	63.4	1.70	
Shawnee	89	34	62.1	0.23	
Stillwater	89	33	57.0	2.97	
Taloga	91	31	59.6	2.50	
Temple	90	33	63.1	0.13	
Ural	94	29	57.4	1.20	
Waukomis	92	31	60.0	0.92	
Weatherford	92	30	59.2	2.10	
Oregon.					
Albany *b*				2.31	
Alpha	75	28	47.4	5.38	2.2
Arlington	78	27	50.6	0.37	
Ashland	80	25	47.5	0.43	1.1
Astoria	66	33	48.1	6.16	T.
Aurora (near)	72	30	48.2	3.14	T.
Bay City	65	29	46.4	10.34	
Bend	76	8	39.1	0.02	1.0
Beulah	78	15	44.6	0.00	
Blackbutte	66	26	46.3	3.30	1.5
Blalock	78	30	53.6	0.24	
Bullrun				5.80	3.5
Cascade Locks	73	33	49.0	3.84	T.
Coquille				2.93	
Corvallis	72	28	47.8	2.67	
Coyote	83[g]	24[i]	53.2[h]	0.18	T.
Dayville	82	21	47.3	0.34	T.
Doraville	67	27	43.6	4.15	0.2
Drain	76	28	48.8	1.68	0.5
Ella				0.28	
Eugene	68[i]	31[h]	48.1[h]	1.41	
Fairview	67	29	48.8	5.86	2.0
Falls City	69	28	45.8	4.57	T.
Forestgrove	71	23	46.8	2.70	
Gardiner	67	31	50.0	5.55	
Glenora	74	28	46.3	9.38	2.5
Government Camp	59	18	34.5	5.12	34.0
Grants Pass	84	21	48.2	0.35	
Grass Valley	65	20	42.4	0.50	
Heppner	76	26	47.0	0.14	
Hood River (near)	72	28	48.2	0.62	
Huntington	80	20	49.6	0.06	
Jacksonville	78	25	51.0	0.25	
Joseph	73	8	38.6	1.55	12.7
Kerby	80	20	47.0	1.06	T.
Klamath Falls	80	17	45.8		
Lagrande	77	21	44.6	0.17	1.5
Lakeview	74	10	41.4	0.48	5.0
Lonerock	71	22	43.4	0.64	2.2
McKenzie Bridge	79	24	46.6	3.18	
McMinnville	70	25	48.0	2.84	T.
Monroe	69	29	47.8	1.82	T.
Mount Angel	68	31	48.1	2.05	
Nehalem				10.50	1.5
Newport	60	32	47.0	6.60	
Pendleton	75	23	48.4	0.30	
Pine	80[d]	25[b]	49.0[f]	0.74	
Placer				1.25	
Salem	69	31	48.9	1.20	
Silverlake	78	12	40.7		
Sparta	70	17	43.8	0.62	5.0
Stafford	69	30	47.2	3.66	
The Dalles	76	28	50.6	0.23	
Toledo	72	29	48.1	6.54	0.2
Umatilla	79	28	52.2	0.01	
Vale	83	15	46.8	0.10	
Wallowa	78	18	42.6	0.51	1.1
Wamic	70	22	44.2	0.05	T.
Warm Spring	75	20	47.0	0.26	
Weston	74	20	44.3	0.61	T.
Williams	81	23	47.8	0.53	
Pennsylvania.					
Aleppo	81	17	51.0	3.96	T.
Altoona	87	17	48.9	2.99	T.
Beaver Dam				2.52	
Bellefonte	87	22	50.9	3.47	
Brookville				4.20	
Browers				3.51	
Butler	80	16	48.0	2.93	T.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
	°	°	°	*Ins.*	*Ins.*
Pennsylvania—Cont'd.					
California	84	20	52.6	3.23	T.
Cassandra	82	16	47.2	2.45	T.
Centerhall	83	19	49.2	3.35	
Clarion				3.34	T.
Coatesville	89	24	51.4	4.38	
Coudersport	80[b]	16	43.2[d]		T.
Confluence				3.66	
Davis Island Dam				2.55	
Derry Station	82	17	50.3	3.91	
Doylestown				4.27	
Dushore	80	18	43.2	2.66	
East Bloomsburg				3.11	
East Mauch Chunk	88	21	50.0	4.40	
Easton	84	25	49.8	4.38	
Ellwood Junction				2.16	
Emporium	82	20	47.0	2.76	T.
Ephrata	86	23	50.6	3.10	
Everett	87[g]	19[g]	49.0[g]	3.71	
Forks of Neshaminy				4.52	
Franklin	82	15	47.9	3.77	T.
Freeport	89	18	50.4	2.70	T.
Girardville				4.23	T.
Grampian	80	14	45.6	3.72	
Greensboro				4.98	T.
Greenville	82	17	47.0	4.11	T.
Hamburg	88	22	50.3	4.02	
Hamlinton	84	17	43.8	3.49	
Hawthorn	82	15	46.4	3.48	
Herrs Island Dam				3.15	
Huntingdon *a*				2.94	
Huntingdon *b*	88	20	49.4	3.04	
Indiana	80	16	48.5		
Irwin	84	15	50.8	3.42	T.
Johnstown	87	19	51.0	4.08	T.
Keating				3.03	
Kennett Square	86	25	51.2	3.99	
Lansdale				3.01	
Lawrenceville	86	19	44.1	2.67	
Lebanon	88	23	51.0	3.67	
Leroy	84	18	44.8	2.97	0.2
Lewisburg	88	23	49.8	4.34	
Lockhaven *a*	89	23	50.8	2.81	
Lockhaven *b*				2.72	
Lock No. 4				3.01	T.
Lycippus	81	16	50.4	2.43	T.
Mifflin				3.59	T.
Milford	87	20	48.0	3.17	
Oil City				3.44	
Ottsville				4.11	
Parker				3.40	T.
Philadelphia	90	28	53.6	4.50	T.
Pocono Lake	79	17	43.4		
Point Pleasant				4.59	
Pottsville				4.77	
Quakertown	88	25	50.4	4.57	T.
Reading	88	26	51.2	4.62	
Renovo *a*	88	21	48.4	3.05	
Renovo *b*				2.77	
Saegerstown	81	12	45.8	3.44	T.
St. Marys	78	15	45.0	3.90	
Saltsburg				3.42	0.2
Seisholtzville				4.84	
Selinsgrove	87	23	50.0	4.39	
Shawmont				3.81	
Smethport	80	16	44.2	2.49	
Smiths Corners				4.71	
Somerset	83	15	48.4	4.52	0.5
South Bethlehem	87	26	51.0	4.59	T.
South Eaton	85	22	47.3	3.29	
Spring Mount				3.67	
State College	83	18	47.7	3.81	
Sunbury				4.26	
Swarthmore	87	25	51.7	3.71	
Towanda	84	23	46.0	2.37	T.
Troutrun				4.28	
Uniontown	83	25	53.0	3.55	T.
Warren	81	16	45.6	3.24	0.7
Wellsboro	82	20	46.2	2.76	T.
Westchester	87	25	51.6	4.53	
West Newton				3.03	
Wilkesbarre	86	22	47.8	3.07	
Williamsport	86	22	49.7	3.67	T.
York	88	25	51.8	3.21	
Rhode Island.					
Bristol	79	27	47.2	4.48	
Kingston	83	23	46.1	6.91	
Pawtucket	85	27	50.2	3.79	
Providence *a*	84	27	48.5	4.01	T.
Providence *c*	83	24	47.6	3.66	
South Carolina.					
Allendale	84	38	62.4	2.60	
Anderson	87	34	60.0	3.10	
Barksdale	85	30	59.6	4.74	
Batesburg	88	31	59.9	3.31	
Beaufort	81	41	63.2	0.85	
Bennettsville	88	33	61.1	3.92	
Blackville	87	37	62.0	4.29	
Bowman	87	37	62.0	2.04	

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
South Carolina—Cont'd.	°	°	°	*Ins.*	*Ins.*
Calhoun Falls	...	...	...	1.82	
Cheraw *a*	85	32	59.0	2.97	
Cheraw *b*	...	...	...	3.78	
Clarks Hill	86	35	61.2	2.08	
Clemson College	86	26	57.4	4.17	
Conway	87	34	60.8	2.50	
Darlington	85	33	60.6	2.63	
Duewest	82	35	59.8	1.70	
Edisto	...	...	...	3.03	
Effingham	...	...	...	3.97	
Florence	85	35	60.8	3.28	
Gaffney	87	30	58.6	3.61	
Gillisonville	85	35	62.4	0.95	
Greenville	83	29	55.4	4.47	
Greenwood	84	35	59.8	2.01	
Heath Springs	84	28	56.6	4.54	
Kingstree *a*	84	35	60.0	2.64	
Kingstree *b*	...	...	...	2.32	
Liberty	87	31	58.6	5.55	
Little Mountain	85	34	60.9	3.04	
Longshore	86	34	59.6	2.35	
St. Georges	85	38	61.2	1.97	
St. Matthews	84	38	60.2	6.02	
St. Stephens	...	...	...	1.68	
Saluda	86	34	61.2	2.23	
Santuck	86	30	58.4	4.75	
Seivern	88	31	59.2	4.29	
Smiths Mills	...	...	...	3.00	
Society Hill	84	35	61.2	3.69	
Spartanburg	87	28	57.4	4.43	
Statesburg	85	34	61.9	2.99	
Summerville	83	37	61.0	2.65	
Sumter	84	36	60.7	1.98	
Temperance	85	35	60.1	2.39	
Trenton	84	35	61.0	2.50	
Trial	84	35	58.8	2.23	
Winnsboro	84	32	59.2	2.54	
Winthrop College	84	33	59.6	3.02	
Yemossee	83	39	62.8	1.90	
Yorkville	88	34	61.2	3.68	
South Dakota.					
Aberdeen	78	17	44.2	2.40	
Academy	79	20	48.9	1.59	2.0
Alexandria	75	14	46.6	0.72	1.0
Armour	78	22	45.0	1.65	2.5
Ashcroft	80	15	46.0	0.72	2.2
Bowdle	75	11	43.6	1.10	4.0
Brookings	75	15	45.2	1.00	3.0
Canton	78	18	48.0	1.26	0.5
Centerville	...	...	...	1.14	4.0
Chamberlain	82	22	50.0	1.41	0.7
Cherry Creek	83	12	47.6	1.02	1.0
Desmet	74	12	44.8	1.20	3.0
Doland	77	13	45.8	2.61	2.0
Elkpoint	77	18	49.8	1.82	1.0
Fairfax	78	16	51.0	2.18	3.0
Farmingdale	...	...	...	1.89	T.
Faulkton	77	17	45.8	1.75	1.0
Flandreau	75	16	45.6	0.92	2.0
Forestburg	80	12	46.8	1.43	3.0
Fort Meade	78	20	47.0	2.55	...
Gannvalley	80	19	49.0	1.02	2.0
Gettysburg	72	20	43.2	1.12	5.2
Grand River School	75	15	47.2	1.35	3.0
Greenwood	79	18	50.8	0.82	3.0
Highmore	...	...	...	0.70	1.0
Hotch City	87	19	47.8	2.88	1.0
Howard	77	13	47.8	1.01	3.0
Howell	78	15	45.8	1.86	1.2
Interior	80	16	45.5	2.00	
Ipswich	76	15	44.0	1.63	1.5
Kimball	81	14	49.4	1.20	1.0
Leola	80	15	44.4	1.45	2.0
Marion	76	14	48.4	1.33	...
Mellette	77	18	46.2	2.29	2.0
Menno	80	14	48.6	0.73	4.0
Millbank	80	20	45.6	1.84	2.0
Mitchell	76	14	47.6	1.10	2.0
Oelrichs	84	19	45.9	2.35	
Pedro	83	15	48.8	0.87	
Pine Ridge	83	21	47.8	1.64	0.5
Plankinton	78	16	49.2	1.64	3.0
Ramsey	76	9	45.9	1.05	4.0
Redfield	78	16	44.3	2.97	1.0
Rosebud	83	20	48.6	2.10	0.7
Silver City	...	...	...	4.49	3.0
Sioux Falls	79	17	46.8	1.12	2.0
Sisseton Agency	76	16	43.8	2.40	1.0
Spearfish	80	29	45.4	5.66	20.0
Tyndall	79	13	49.8	1.82	...
Vermillion	80	17	49.2	2.33	1.0
Watertown	75	15	43.5	1.29	1.0
Waubay	74	10	44.0	1.83	...
Wentworth	77	15	45.9	0.72	1.5
Wolsey	...	...	...	1.53	2.5
Tennessee.					
Andersonville	82	25	55.6	6.65	T.
Arlington	82	36	59.2	3.13	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Tennessee—Cont'd.	°	°	°	*Ins.*	*Ins.*
Ashwood	82	29	57.3	2.23	
Benton	84	28	57.9	5.89	
Bluff City	...	...	...	5.18	
Bolivar	83	32	57.7	2.85	
Bristol	83	23	52.0	5.14	T.
Brownsville	88	36	59.3	0.30	
Byrdstown	83	29	56.4	5.97	
Carthage	84	30	57.6	5.41	
Callettsburg	...	...	...	7.89	
Charleston	...	...	...	6.95	
Clarksville	83	31	57.7	2.18	
Clinton	...	...	...	8.42	
Covington	79	34	60.0	1.90	
Decatur	84	29	57.1	6.58	
Dickson	80	27	56.6	5.43	
Elizabethton	82	25	52.1	4.63	T.
Erasmus	81	24	53.0	7.29	T.
Florence	80	31	57.4	4.40	
Franklin	81	30	57.2	4.66	
Grace *[1]	86	28	53.8	7.40	
Greeneville	82	25	54.3	8.42	T.
Halls Hill	...	...	...	5.71	
Harriman	82	28	55.8	7.39	
Hohenwald	82	25	57.1	3.58	
Iron City	82	29	57.8	3.39	
Isabella	79	28	52.4	3.09	T.
Jackson	84	29	60.0	1.56	
Johnsonville	85	30	58.6	4.78	
Jonesboro	80	26	53.4	8.64	T.
Kenton	81	31	58.3	3.32	
Kingston	...	...	...	7.26	
Leadvale	...	...	...	6.70	
Lebanon	82	28	57.2	5.90	
Lewisburg	82	28	57.6	4.42	
Liberty	85	...	...	6.10	
Lynnville	79	32	56.2	3.77	
McKenzie	84	32	59.6	3.26	
McMinnville	84	27	56.4	4.69	
Maryville	84	31	57.2	7.15	T.
Milan	83	31	58.1	3.70	
Newport	81	29	56.0	7.03	
Nunnelly	85	28	57.8	2.93	
Oakhill	84	27	56.0	5.37	
Palmetto	81	30	57.8	5.49	
Pope	88	28	59.6	2.07	
Rogersville	83	27	55.3	5.98	T.
Rugby	84	22	52.8	6.75	T.
Savannah	88	32	59.7	2.20	
Sewanee	80	25	54.6	4.95	T.
Silverlake	77	20	50.0	4.90	T.
Springdale	84	25	54.4	6.64	T.
Springville	84	29	58.4	3.60	
Tazewell	...	...	...	6.02	T.
Tellico Plains	85	28	58.6	6.83	T.
Tracy City	80	27	54.2	5.75	T.
Trenton	86	29	59.3	3.95	
Tullahoma	85	28	57.4	5.66	
Waynesboro	89	30	58.6	3.27	
Wildersville	82	34	59.6	2.56	
Yukon	80	30	57.6	3.17	
Texas.					
Albany	86	32	64.6	0.51	
Alvin	91[d]	48[d]	70.2[d]	1.79	
Arthur	...	...	...	0.40	
Austin *a*	87	42	66.4	1.27	
Austin *b* *[3]	86	38	64.1	...	
Ballinger	95	37	63.4	0.14	
Bastrop	98	38	66.9	1.90	
Beaumont	90	...	...	2.22	
Beeville	93	47	68.8	1.31	
Bigspring	95	33	64.4	0.08	
Blanco	88	33	62.3	2.08	
Boerne *[1]	85	40	64.1	2.03	
Bonham	88	36	64.3	0.29	
Booth	...	...	...	2.95	
Bowie	91	32	64.1	0.15	
Brazoria	88	42	67.6	2.31	
Brenham	88	43	67.3	1.91	
Brighton	85	48	69.4	0.90	
Brownwood	...	...	...	T.	
Burnet	93	37	65.2	0.27	
Camp Eagle Pass	96	41	70.2	0.30	
Childress	94	30	62.2	1.30	
Clarksville	86	34	63.2	1.60	
Coleman	91	35	62.8	1.20	
College Station	88	...	...	1.25	
Colorado	...	35	...	1.10	
Columbia	89	42	68.2	2.05	
Comanche	92	33	63.8	0.76	
Corsicana	96	32	63.0	0.12	
Cotulla	91	50	69.7	0.04	
Cuero	91	40	68.8	2.30	
Dallas	90	37	63.6	0.89	
Danevang	90	42	66.8	1.55	
Dublin	91	34	63.8	0.95	
Duval	88	40	68.0	1.11	
Estelle	90	36	65.0	0.75	
Fort Clark	90	38	65.0	0.60	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Texas—Cont'd.	°	°	°	*Ins.*	*Ins.*
Fort Davis	88	30	61.0	0.43	
Fort McIntosh	96	42	72.2	0.00	
Fort Ringgold	97	50	74.9	0.00	
Fort Stockton	...	...	...	0.22	
Fredericksburg	90	36	64.0	1.13	
Gainesville	87[c]	33	63.4	1.18	
Gatesville	93	36	66.2	0.29	
Georgetown	88	34	65.8	1.25	
Grapevine	89	35	65.4	0.68	
Greenville	90	36	65.2	0.23	
Hale Center	89	30	60.4	2.35	
Hallettsville	89	44	68.6	2.57	
Haskell	97	32	64.0	0.72	
Hearne	91	42	69.0	0.61	
Henrietta	92	31	63.7	0.33	
Hewitt	...	...	...	0.63	
Hondo	...	...	...	1.50	
Houston	89	45	69.6	3.85	
Huntsville	85	33	64.6	1.31	
Ira	97	32[d]	63.6	0.35	
Jacksonville	85	38	65.0	0.32	
Jasper	86	40	67.8	1.85	
Junction	...	...	...	0.71	
Kaufman	88	38	65.3	0.25	
Kent	90	31	63.4	0.24	
Kerrville	89	32	63.4	2.38	
Kopperl	...	...	...	0.20	
Lampasas	95	34	63.8	0.45	
Lapara	...	...	...	1.77	
Laureles Ranch	...	...	...	0.94	
Llano	95	41	63.1	0.35	
Longview	88	39	64.6	0.52	
Luling	88	40	66.7	2.40	
McKinney	86	34	61.1	0.41	
Mann	88	37	65.7	0.24	
Marlin	85	32	64.4	1.65	
Menardville	94	30	63.9	0.38	
Mount Blanco	91	29	59.4	1.05	
Nacogdoches	86	35	64.2	1.23	
New Braunfels	87	38	67.2	1.82	
Panter	...	...	...	0.42	
Paris *a*	88	33	63.2	0.47	
Pearsall	90	49	68.6	0.08	
Port Lavaca	87	49	69.0	1.06	
Rhineland	93	31	62.4	1.60	
Rockisland	89	42	67.1	2.35	
Rockport	83	52	67.8	0.68	
Runge	92[f]	40[f]	68.4[f]	2.63	
Sanderson	86	50	65.5	0.00	
San Saba	95	33	65.4	1.13	
Sherman	84	37	61.6	0.56	
Sonora	92	37	65.2	1.04	
Sugarland	90	43	68.3	2.51	
Sulphur Springs	86	38	65.0	0.15	
Temple *a*	86	37	64.6	0.96	
Temple *b*	87	36	64.1	0.90	
Trinity	87	37	66.6	0.88	
Tyler	86	40	65.4	1.03	
Victoria	...	...	...	1.03	
Waco	91	40	67.0	0.20	
Waxahachie	...	...	...	T.	
Weatherford	91	35	64.7	1.59	
Wharton	92	48	70.8	1.60	
Wichita Falls	...	...	...	0.35	
Utah.					
Aneth	84	27	53.1	0.59	
Blackrock	82	19	46.2	2.59	8.5
Callao[e]	85	8	48.8	T.	
Castledale	83	5	43.6	0.10	
Corinne	84	23	47.4	1.11	
Coyoto[h]	77	17	43.4	0.01	
Deseret	82	16	46.5	0.90	1.0
Emery	76	14	40.8	T.	
Escalante	79	20	47.4	0.56	
Farmington	76	21	47.4	1.81	2.9
Fillmore	85	19	47.9	2.66	
Fort Duchesne	79	13	44.3	0.00	
Frisco	79	15	44.5	1.49	...
Garrison	81	15	46.0	0.38	0.5
Giles	84	14	49.6	0.72	
Government Creek	76	16	44.8	1.07	2.0
Green River	91	19	54.2	0.50	
Grover	95	14	43.2	0.30	0.3
Heber	75	16	42.7	0.78	
Henefer	78	13	42.0	1.11	3.0
Hite	91	34	57.6	0.26	
Huntsville	...	...	...	1.33	T.
Ibapah	77	7	43.5	...	
Kanab	87	30	52.0	2.79	
Kelton	76	19	44.6	0.78	
La Sal	72	15	43.2	0.61	
Levan	78	18	44.8	2.03	2.1
Loa	73	4	36.0	0.00	
Logan	76	17	45.8	2.01	
Lund	80	21	46.1	0.94	1.5
Manti	78	18	44.4	1.22	...
Marysvale	76	16	43.6	0.70	5.2
Meadowville	68	13	38.9	0.80	1.0

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Utah—Cont'd.	°	°	°	*Ins.*	*Ins.*
Millville				1.78	
Moab	89	25	54.4	0.69	T.
Monticello	72	17	42.6	0.77	1.0
Morgan	78	14	43.0	0.81	
Mount Nebo	82	22	49.0	0.44	
Mount Pleasant	79	18	45.4	1.41	
Ogden *a*	82	22	48.5	1.48	
Park City	80	8	40.4	0.95	9.5
Parowan	78	17	44.6	1.06	8.7
Pinto	74	19	42.2	1.30	.....
Plateau	73	10	40.6	1.31	14.1
Provo	84	19	48.2	0.51	0.7
Ranch	73	16	41.2	2.28	
St. George	94	24	56.4	0.60	
Scipio	83	17	45.8	1.83	8.0
Snowville	77	4	42.5	1.66	
Soldier Summit	72	25	47.8	.....	
Terrace	78	19	46.8	0.45	0.5
Thistle	80	30	50.0	1.75	2.0
Tooele	79	18	46.8	1.73	
Tropic	79	20	44.4	0.74	
Vernal	81	16	47.8	0.67	2.0
Wellington [g]	80	10	46.2	.....	
Woodruff	75	11	38.2	0.72	5.0
Vermont.					
Bellows Falls				1.22	T.
Burlington	82	18	46.0	1.63	T.
Cavendish	86	14	43.2	1.04	3.1
Chelsea	78	9	39.6	0.80	4.0
Cornwall	84	11	45.0	1.08	
Enosburg Falls	83	5	40.5	2.95	3.0
Hartland	87	15	43.4	0.99	
Jacksonville	80	13	41.5	3.01	3.0
Manchester	80	15	43.7	1.50	1.0
Morrisville	85	10	41.6	1.44	3.6
Norwich	86	14	42.2	1.13	2.5
St. Johnsbury	86	10	42.0	1.23	2.0
Wells	78	12	41.8	0.91	1.0
Woodstock	79	6	43.2	1.03	.....
Wells River				2.43	.....
White River Junction				1.09	0.5
Virginia.					
Alexandria	90	27	54.8	3.32	
Ashland	88	27	55.8	5.57	
Barboursville	89	25	55.6	3.90	
Bedford	89	25	57.4	2.92	
Bigstone Gap	83	26	54.3	7.43	T.
Blacksburg	81	19	50.5	4.02	T.
Bluemont	88	22	54.4	3.05	
Bonair	88	28	56.4	6.12	
Boykins				6.30	
Burkes Garden	75	18	47.2	5.97	T.
Callaville	88	27	56.7	4.24	
Charlottesville	91	25	56.0	3.81	
Clarksville				6.43	
Columbia	89	20	52.9	4.60	
Dale Enterprise	86	16	51.5	3.13	T.
Danville				4.55	
Farmville	88	27	55.4	4.12	
Fredericksburg	91	25	54.7	4.37	
Grahams Forge [a]	82	29	50.3	2.31	T.
Hampton	84	30	55.8	4.14	
Hot Springs	80	12	48.7	3.67	
La Crosse	86	28	57.6	7.11	
Lexington	85	24	53.2	3.34	
Lincoln	92	23	52.4	3.38	
Manassas	87	25	53.1	4.12	
Marion	80^{e}	20^{d}	51.0^{d}	5.15	
Mendota				6.18	T.
Newport News	86	40	57.6	3.25	
Petersburg	89	37	57.2	4.63	
Quantico	89	27	54.6	.....	
Radford				2.36	
Riverton				3.63	
Roanoke	80	25	52.0	3.86	
Rockymount	80	27	52.6	3.53	
Saxe	87	25	54.4	4.72	
Shenandoah				3.58	
Speers Ferry				5.72	T.
Spottsville	88	28	56.8	5.32	
Stanardsville	88	30	52.2	2.87	
Staunton	86	22	54.5	3.87	
Stephens City	90	22	53.3	3.97	
Warsaw	89	26	55.8	3.25	
Westpoint	83	22	53.6	4.85	
Wilkerson	89	28	55.4	4.26	
Williamsburg	84	28	56.2	3.84	
Woodstock	89	23	51.9	3.80	
Wytheville	82	21	51.8	3.78	T.
Washington.					
Aberdeen	61	29	45.0	5.92	T.
Anacortes				2.36	
Ashford				3.41	3.0
Blaine	64	27	45.9	1.49	
Bremerton	67	29	45.6	1.98	
Brinnon	66	29	46.8	2.77	T.
Cedonia	70	19	41.2	0.94	2.5
Centralia	74	25	47.0	2.68	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
Washington—Cont'd.	°	°	°	*Ins.*	*Ins.*
Cheney				0.72	2.2
Clearbrook	67	25	47.6	1.91	
Clearwater	67	30	45.8	9.30	
Cle Elum	66	21	41.2	1.10	T.
Colfax	80	21	44.9	0.36	
Colville	74	21	44.2	0.43	0.3
Conconully	71	22	43.4	0.47	1.2
Coupeville	65	32	47.2	2.25	0.5
Crescent	78	22	43.0	0.09	0.3
Dayton	74	28	47.3	0.81	T.
East Sound	64	25	44.8	1.49	
Ellensburg	70	21	44.6	0.51	
Ephrata	74^{e}	26^{e}	51.4^{e}	0.82	
Grandmound	68	25	46.2	3.77	T.
Granite Falls				8.05	
Hooper	75^{e}	22^{e}	47.8^{e}	0.06	T.
Ilwaco	69	31	46.5	8.47	T.
Lacenter	72	29	46.8	3.77	T.
Lakeside	68	30	48.5	0.61	
Lind	78	22	49.0	0.37	T.
Loomis	72	28	48.9	0.20	T.
Maple Valley				5.14	1.5
Mottinger Ranch	79	28	53.3	0.02	
Mount Pleasant	71	31	47.4	3.82	T.
Moxee	81	19	46.8	0.42	T.
Northbend	70	30	42.3	8.14	26.0
Northport	72	20^{i}	44.2^{d}	1.41	0.8
Odessa	78^{e}	18	44.8	0.20	
Olga	62	32	47.1	1.36	
Olympia	72	27	47.5	3.92	
Pateros				0.21	
Pinehill	73	27	48.5	0.35	T.
Pomeroy	83	22	47.8	0.80	0.5
Port Townsend	62	33	47.2	1.51	
Pullman	78	24	44.6	1.09	3.5
Ritzville				T.	
Ritzville (near)				0.23	0.5
Rosalia	77	25	43.2	0.44	0.9
Sedro-Woolley	67	28	47.6	6.35	T.
Silvana [a]	66	29	47.5	2.14	
Snohomish	69	29	45.9	2.62	T.
Snoqualmie	64	31	46.0	3.05	
Southbend	69	30	45.9	7.67	0.5
South Ellensburg	72	20	43.8	0.26	T.
Sprague				0.75	
Sunnyside	76	22	48.5	0.35	
Trinidad	78	28	49.8	0.40	
Twisp	69	21	44.4	0.38	2.0
Union	66^{f}	29^{e}	46.4^{e}	4.59	T.
Usk	73	22	42.4	1.01	2.5
Vancouver	74	30	49.0	2.40	
Vashon	64	32	46.8	2.43	
Waterville	70	24	42.7	0.73	0.5
Wenatchee (near)	70	24	45.2	0.41	
Whatcom	68	30	47.4	1.85	
Wilbur	73	16	41.8	0.46	0.2
Zindel	83	30	52.6	1.38	T.
West Virginia.					
Addison	85	19	52.8	3.75	0.5
Bayard	83	15	46.4	3.47	T.
Beverly	80	14	47.5	3.45	1.0
Bluefield	78	19	57.3	3.75	
Buckhannon	84	18	49.9	4.15	T.
Burlington	87	19	50.3	3.50	T.
Byrne	87	20	52.7	5.50	1.0
Cairo	86	22	53.6	6.19	T.
Camden	82	20	51.5	4.38	T.
Central	85	17	50.0	4.84	T.
Chapel	82	20	50.5	5.81	0.5
Charleston *a*	90	23	58.6	.....	
Charleston *b*				5.95	T.
Creston	84	20	53.1	5.28	
Cuba	84	20	52.8	5.04	T.
Dayton	85	15	50.4	4.00	T.
Echo	87	22	55.4	5.47	T.
Elkhorn	83	22	52.7	5.50	0.6
Fairmont				3.46	
Glenville	85	20	51.8	4.66	T.
Grafton	84	18	51.6	3.70	T.
Green Sulphur	80	18	48.8	3.43	
Harpers Ferry				4.95	
Hinton	82^{i}	23^{i}	51.4^{i}	3.54	T.
Huntington	85	23	53.5	3.58	
Josiah	83	22	52.4	6.34	T.
Leonard	78	16	49.0	6.36	2.5
Lewisburg	80	18	48.8	3.97	T.
Lillydale	83	19	51.9	4.12	0.3
Logan	89	25	57.7	7.30	0.0
Magnolia	91	19	50.4	3.62	
Mannington	84	19	52.4	3.61	T.
Marlinton	79	18	47.2	4.04	T.
Martinsburg	86	22	49.3	4.55	
Morgantown	83	18	52.2	3.55	T.
Moscow	80	18	49.6	2.70	T.
Moundsville	82	21	52.8	3.76	T.
New Martinsville	88	22	52.4	3.95	T.
Nuttallburg	83	17	52.7	5.95	
Oldfields	89	18	51.6	3.02	

Stations.	Temperature. (Fahrenheit.) Maximum.	Minimum.	Mean.	Precipitation. Rain and melted snow.	Total depth of snow.
West Virginia—Cont'd.	°	°	°	*Ins.*	*Ins.*
Philippi	85	17	51.7	4.24	T.
Pickens	84	12	49.4	6.19	4.0
Point Pleasant	85	23	56.6	4.78	T.
Powellton	86^{e}	24^{e}	53.3^{e}	5.24	T.
Princeton	78	26	51.4	7.45	1.5
Romney	87	22	52.1	3.74	
Rowlesburg				4.24	
Ryan	85	20	52.8	5.85	
Summersville	83^{e}	15^{e}	51.0^{e}	4.62	T.
Southside	84	26	55.3	5.21	
Terra Alta	80	12	46.8	2.50	T.
Travellers Repose	79	8	45.9	3.36	2.0
Uppertract	86	17	51.4	2.29	T.
Valley Fork	85	21	54.1	6.09	T.
Wellsburg	78	20	49.6	3.60	0.5
Weston				4.20	
Wheeling *a*				2.04	T.
Wheeling *b*	83	23	55.8	3.71	
Williamson	87	25	54.0	7.13	0.0
Wisconsin.					
Amherst	73	21	44.5	3.40	1.0
Antigo	70^{g}	22^{g}	43.5^{g}	0.75^{g}	5.5
Appleton	66	21	44.6	2.31	0.2
Ashland				2.03	1.5
Barron	74	18	44.2	2.44	1.4
Beloit	80	27	49.4	3.05	T.
Brodhead	79	28	49.6	2.70	T.
Butternut	71	14	40.0	3.61	3.0
Chilton	70	21	44.0	3.37	0.7
Chippewa Falls				2.34	
Darlington	75	22	47.2	4.24	.....
Delavan	79	24	47.6	2.77	.....
Downing	72	18	43.2	3.55	2.2
Easton	73	19	46.2	2.98	4.0
Eau Claire	75	22	47.3	3.72	0.8
Florence	70	13	38.1	3.28	6.0
Fond du Lac	76	23	47.6	3.02	.....
Grand Rapids	71	22	46.0	2.27	
Grand River Locks				4.16	.....
Grantsburg	69	13	42.0	4.55	4.0
Hancock	72	19	45.4	3.04	.....
Harvey	78	24	46.6	2.16	1.0
Hayward	73	8	42.0	1.49	4.0
Hillsboro	70	24	46.4	4.30	1.5
Koepenick	73	10	42.1	4.20	15.0
Lancaster	73	23	47.2	4.43	1.0
Madison	74	28	46.6	2.88	1.0
Manitowoc	70	23	42.8	4.01	3.0
Meadow Valley	74	22	46.5	3.27	2.0
Medford	73	18	43.7	3.95	2.0
Menasha				2.55	.....
Neillsville	72	22	46.9	3.41	2.0
New London	71	20	44.3	2.82	T.
Oconto	72	19	44.0	2.91	1.0
Osceola	69	14	42.4	2.92	2.5
Oshkosh	69	21	46.6	2.32	.....
Pine River [g]	70	19	45.4	2.22	1.0
Portage	77	25	48.7	4.08	2.0
Port Washington	70	22	42.8	3.68	0.5
Prairie du Chien *a*	75	25	49.2	3.36	.....
Prairie du Chien *b*				3.50	T.
Racine	75	26^{e}	48.2^{e}	2.76	
Sheboygan	71	23	43.9	3.90	T.
Spooner	74	14	42.0	3.17	.....
Stevens Point	71	18	45.8	2.94	.....
Tomahawk	70	10	41.6	1.87	1.0
Valley Junction	74	22	47.2	2.47	2.0
Viroqua	71	23	45.5	4.68	2.5
Waukesha	77	24	46.4	2.51	0.1
Waupaca	72	17	45.4	2.83	1.0
Wausau	68^{e}	17	43.7	3.89	
Whitehall	79	22	46.8	4.13	
Wyoming.					
Afton	70	1	36.4	2.28	13.3
Alcova	80^{i}	11	45.6^{d}	1.22	T.
Basin	83	14	45.6	0.86	3.1
Bedford	67	2	34.6	2.55	.....
Border	73	1	36.0	1.81	.....
Buffalo	75	15	42.2	1.37	3.8
Centennial	47	10	33.6	0.72	
Chugwater	77	5	43.2	1.86	7.2
Daniel	65	1	31.7	1.53	.....
Embar	77	0	40.4	0.53	5.3
Evanston	69	8	36.8	1.22	3.0
Fontenelle	71	7	37.2	0.33	3.3
Fort Laramie	78	17	45.8	1.53	22.3
Fort Washakie	73	11	42.0	1.90	10.0
Fort Yellowstone	68	8	36.8	0.80	8.0
Fourbear	67	6	35.7	0.62	5.5
Griggs	75	4	42.1	1.97	12.1
Hyattville	80	-15	45.5	1.06	T.
Irma	74	14	42.0	0.90	3.2
Iron Mountain	69	10	41.2	0.51	T.
Kimball Ranch	76	18	41.3	1.48	4.5
Laramie	66	1	37.5	0.73	8.0
Leo	67	4	38.0	1.46	9.5
Lolabama Ranch	66	2	33.2	1.24	15.5
Lusk	80	12	41.4	1.66	7.2

TABLE II.—*Climatological record of voluntary and other cooperating observers*—Continued.

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Wyoming—Cont'd.	°	°	°	*Ins.*	*Ins.*
Moorcroft	80	15	44.6	2.84	12.0
Moore	72	13	42.3	0.79	
Parkman	76	12	43.2	1.06	......
Pinebluff	78	10	44.3	0.47	2.0
Rawlins	69	10	40.0	1.96	
Red Bank	70	10	41.4	4.02	......
Rocksprings	71	11	43.8	0.70	6.8
Saratoga	70	13	39.7	0.65	2.0
South Pass City	69	3	33.8	2.20	22.0
Tensleep	76	11	45.2	1.20	1.0
Thayne	70	4	36.0	1.49	2.6
Thermopolis	63	16	33.0	......	
Porto Rico.					
Adjuntas	89	52	72.4	3.84	
Aguadilla	95	65	79.2	5.21	
Aguirre	90	63	77.4	0.83	
Arecibo	93	......	......	3.07	
Barros	85	51	71.8	9.53	
Bayamon	90	60	75.0	3.64	
Caguas	99	53	78.2	5.03	
Canovanas	95	69	80.0	3.70	
Cayey	87	55	72.7	2.90	
Cidra	89	53	71.8	6.65	
Corozal	91	58	75.0	7.46	
Fajardo	90	66	78.6	2.98	
Guanica	91	58	77.0	4.43	
Hacienda Coloso	92	58	75.4	5.35	
Hacienda Josefa	......	......	......	0.55	
Hacienda Perla	94	65	79.4	7.51	
Humacao	90	74	82.8	2.33	
Isabela	88	64	75.3	8.01	
Juan Diaz	91	62	78.0	1.40	
La Carmelita	85	61	73.1	7.26	
La Isolina	91	59	74.8	13.73	
Las Marias	91	63	76.6	7.89	
Manati	96	62	77.2	9.84	
Maunabo	90	65	78.4	1.05	
Mayaguez	93	60	77.2	1.74	
Morovis	91	60	75.4	12.55	
Rio Piedras	......	......	......	6.77	
San German	93	66	80.2	4.09	
San Lorenzo	92	57	75.6	3.32	
San Salvador	88	60	73.4	5.77	
Santa Isabel	92	62	78.2	2.15	
Utuado	93	56	74.4	6.35	
Vieques	89	68	78.8	2.20	
Yauco	88	61	77.8	3.67	

Stations.	Temperature. (Fahrenheit.)			Precipitation.	
	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Mexico.	°	°	°	*Ins.*	*Ins.*
Ciudad P. Diaz	89	43	66.2	0.24	
Coatzacoalcos	......	......	......	0.76	
Leon de Aldamas	90	52	70.4	0.34	
Vera Cruz	86	64	75.3	1.40	
New Brunswick.					
St. John	71	18	39.6	6.02	3.1
Isthmus of Panama.					
Alhajuela	98	66	82.9	0.47	
Bohio	......	......	......	3.55	
Colon	......	......	......	1.65	
Gamboa	......	......	......	0.43	
La Boca	90	72	81.5	1.26	

Late reports for March, 1903.

Stations.	Maximum.	Minimum.	Mean.	Rain and melted snow.	Total depth of snow.
Alaska.					
Copper Center	40	−25	11.8	0.40	4.0
Fort Egbert	38	−33	8.8	0.54	8.7
Fort Liscum	39	2	21.8	4.72	10.5
Kenai	44	−13	19.0	0.44	8.0
Killisnoo	46	10	29.4	0.20	2.0
Sitka	50	11	34.0	2.57	0.8
Skagway	48	5	29.0	0.43	T.
Tyoonok	49	0	24.2	0.45	5.0
Wood Island	60	19	37.6	0.39	2.5
California.					
Meadow Valley *[1]	68	17	37.0	20.85	......
Iowa.					
Monticello	75	15	41.3	2.25	5.0
Newton	70	12	39.4	1.41	8.0
Villisca	75	12	40.2	1.65	6.5
Montana.					
Anaconda	60	− 3	31.4	0.95	9.0
Crow Agency	69	− 1	32.0	0.80	8.0
Nebraska.					
Hartington	67	7	31.5	1.03	T.
Schuyler	......	......	......	0.75	7.0
Nevada.					
Beowawe *[1]	66	18	40.7	2.36	11.5
New York.					
Honeymead Brook	71	18	43.8	3.83	
Ohio.					
Richwood	......	......	......	2.62	0.2
Vermont.					
Hartland	76	10	39.7	4.78	......

EXPLANATION OF SIGNS.

*Extremes of temperature from observed readings of dry thermometer.

A numeral following the name of a station indicates the hours of observation from which the mean temperature was obtained, thus:

[1] Mean of 7 a. m. + 2 p. m. + 9 p. m. + 9 p. m. ÷ 4.
[2] Mean of 8 a. m. + 8 p. m. ÷ 2.
[3] Mean of 7 a. m. + 7 p. m. ÷ 2.
[4] Mean of 6 a. m. + 6 p. m. ÷ 2.
[5] Mean of 7 a. m. + 2 p. m. ÷ 2.

The absence of a numeral indicates that the mean temperature has been obtained from daily readings of the maximum and minimum thermometers.

An italic letter following the name of a station, as "Livingston *a*," "Livingston *b*," indicates that two or more observers, as the case may be, are reporting from the same station. A small roman letter following the name of a station, or in figure columns, indicates the number of days missing from the record; for instance "n" denotes 14 days missing.

No note is made of breaks in the continuity of temperature records when the same do not exceed two days. All known breaks, of whatever duration, in the precipitation record receive appropriate notice.

TABLE III.—*Resultant winds from observations at 8 a. m. and 8 p. m., daily, during the month of April, 1903.*

Stations.	Component direction from— N.	S.	E.	W.	Resultant. Direction from—	Duration.
New England.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Eastport, Me	23	17	16	19	n. 27 w.	7
Portland, Me	23	16	11	24	n. 62 w.	15
Concord, N. H	18	2	9	8	n. 3 e.	16
Northfield, Vt	30	22	11	7	n. 27 e.	9
Boston, Mass	22	13	17	22	n. 29 w.	10
Nantucket, Mass	25	18	13	17	n. 30 w.	8
Block Island, R. I	22	18	15	20	n. 51 w.	6
Narragansett, R. I.*	11	8	7	11	n. 53 w.	5
New Haven, Conn	31	11	14	15	n. 3 w.	20
Middle Atlantic States.						
Albany, N. Y	27	12	10	24	n. 43 w.	20
Binghamton, N. Y.†	18	3	8	7	n. 4 e.	15
New York, N. Y	26	13	14	19	n. 21 w.	14
Harrisburg, Pa	22	12	21	17	n. 22 e.	11
Philadelphia, Pa	27	8	17	17	n.	19
Scranton, Pa	33	13	19	10	n. 24 e.	22
Atlantic City, N. J	21	17	13	23	n. 68 w.	11
Cape May, N. J	20	21	14	14	s.	1
Baltimore, Md	26	11	14	21	n. 25 w.	17
Washington, D. C	30	15	12	18	n. 22 w.	16
Cape Henry, Va.†	10	9	3	15	n. 85 w.	12
Lynchburg, Va	26	16	9	27	n. 61 w.	21
Norfolk, Va	21	22	10	16	s. 80 w.	6
Richmond, Va	24	20	11	18	n. 60 w.	8
Wytheville, Va	14	15	5	36	s. 88 w.	31
South Atlantic States.						
Asheville, N. C	29	17	11	14	n. 14 w.	12
Charlotte, N. C	20	29	9	13	s. 24 w.	10
Hatteras, N. C	22	17	6	29	n. 78 w.	24
Kittyhawk, N. C.*	9	13	8	9	s. 14 w.	4
Raleigh, N. C	22	21	8	22	n. 86 w.	14
Wilmington, N. C	15	21	9	30	s. 74 w.	22
Charleston, S. C	18	24	7	24	s. 71 w.	18
Columbia, S. C	17	23	13	23	s. 59 w.	12
Augusta, Ga	16	21	13	23	s. 63 w.	11
Savannah, Ga	19	23	5	27	s. 80 w.	22
Jacksonville, Fla	18	20	16	23	s. 74 w.	7
Florida Peninsula.						
Jupiter, Fla	17	16	20	20	n.	1
Key West, Fla	22	7	33	12	n. 55 e.	26
Tampa, Fla	22	10	16	27	n. 43 w.	16
Eastern Gulf States.						
Atlanta, Ga	20	25	6	25	s. 75 w.	20
Macon, Ga.†	12	11	3	12	n. 84 w.	9
Pensacola, Fla.†	12	8	9	10	n. 14 w.	4
Mobile, Ala	21	24	8	18	s. 73 w.	10
Montgomery, Ala	18	22	13	20	s. 60 w.	8
Meridian, Miss.†	10	12	2	8	s. 72 w.	6
Vicksburg, Miss	19	23	17	13	s. 45 e.	6
New Orleans, La	20	26	10	16	s. 45 w.	8
Western Gulf States.						
Shreveport, La	15	28	15	16	s. 4 w.	13
Fort Smith, Ark	15	18	25	15	s. 73 e.	10
Little Rock, Ark	18	24	13	18	s. 40 w.	8
Corpus Christi, Tex	13	28	31	5	s. 60 e.	30
Fort Worth, Tex	19	27	15	14	s. 7 e.	8
Galveston, Tex	12	31	20	13	s. 20 e.	20
Palestine, Tex	17	31	9	11	s. 8 w.	14
San Antonio, Tex	19	27	30	3	s. 73 e.	28
Taylor, Tex †	10	15	4	8	s. 39 w.	6
Ohio Valley and Tennessee.						
Chattanooga, Tenn	16	22	9	24	s. 68 w.	16
Knoxville, Tenn	21	20	4	27	n. 88 w.	23
Memphis, Tenn	19	22	15	18	s. 45 w.	4
Nashville, Tenn	21	23	10	21	s. 80 w.	11
Lexington, Ky. †	7	15	6	9	s. 21 w.	8
Louisville, Ky	16	22	13	17	s. 34 w.	7
Evansville, Ind.†	9	13	6	7	s. 14 w.	4
Indianapolis, Ind	21	26	7	11	s. 39 w.	6
Cincinnati, Ohio	19	20	17	17	s.	1
Columbus, Ohio	22	23	11	14	s. 72 w.	3
Pittsburg, Pa	25	18	20	14	n. 41 e.	9
Parkersburg, W. Va	22	18	15	14	n. 14 e.	4
Elkins, W. Va	25	16	5	25	n. 66 w.	22
Lower Lake Region.						
Buffalo, N. Y	17	19	18	18	s.	2
Oswego, N. Y	18	18	13	24	w.	11
Rochester, N. Y	19	14	17	25	n. 58 w.	9
Syracuse, N. Y	21	13	8	28	n. 68 w.	22
Erie, Pa	18	15	17	24	n. 67 w.	8
Cleveland, Ohio	23	18	18	14	n. 39 e.	6
Sandusky, Ohio †	11	7	10	9	n. 14 e.	4
Toledo, Ohio	21	16	20	16	n. 39 e.	6
Detroit, Mich	23	13	19	18	n. 6 e.	10
Upper Lake Region.						
Alpena, Mich	23	15	26	11	n. 62 e.	17
Escanaba, Mich	32	16	10	13	n. 11 w.	16
Grand Haven, Mich	23	17	18	15	n. 27 e.	7
Houghton, Mich.†	8	3	16	5	n. 66 e.	12
Marquette, Mich	29	12	14	19	n. 16 w.	18
Port Huron, Mich	24	15	21	15	n. 34 e.	11
Sault Ste. Marie, Mich	19	10	24	21	n. 18 e.	10
Chicago, Ill	22	21	23	10	n. 86 e.	13
Milwaukee, Wis	27	15	15	11	n. 18 e.	13
Green Bay, Wis	24	19	21	10	n. 66 e.	12
Duluth, Minn	31	4	24	15	n. 18 e.	28
North Dakota.	*Hours.*	*Hours.*	*Hours.*	*Hours.*	°	*Hours.*
Moorhead, Minn	27	17	18	14	n. 22 e.	11
Bismarck, N. Dak	29	13	18	10	n. 27 e.	18
Williston, N. Dak	17	20	20	19	s. 18 e.	3
Upper Mississippi Valley.						
Minneapolis, Minn.*	16	6	10	6	n. 22 e.	11
St. Paul, Minn	27	14	19	15	n. 17 e.	14
La Crosse, Wis. †	13	12	4	3	n. 45 e.	1
Davenport, Iowa	18	18	13	19	w.	6
Des Moines, Iowa	25	20	11	14	n. 31 w.	6
Dubuque, Iowa	25	21	15	12	n. 37 e.	5
Keokuk, Iowa	23	21	13	17	n. 63 w.	4
Cairo, Ill	17	26	10	20	s. 48 w.	14
Springfield, Ill	20	24	13	18	s. 51 w.	6
Hannibal, Mo. †	9	13	4	9	s. 51 w.	6
St. Louis, Mo	19	27	7	14	s. 41 w.	11
Missouri Valley.						
Columbia, Mo. *	12	12	4	6	w.	2
Kansas City, Mo	21	25	10	18	s. 63 w.	9
Springfield, Mo	21	25	11	17	s. 56 w.	7
Topeka, Kans.*	11	11	6	7	w.	1
Lincoln, Nebr	27	22	10	10	n.	5
Omaha, Nebr	28	19	9	11	n. 13 w.	9
Valentine, Nebr	29	17	12	13	n. 5 w.	12
Sioux City, Iowa †	15	9	9	5	n. 34 e.	7
Pierre, S. Dak	22	18	22	12	n. 68 e.	11
Huron, S. Dak	27	17	19	12	n. 35 e.	12
Yankton, S. Dak. †	13	5	8	12	n. 27 w.	9
Northern Slope.						
Havre, Mont	16	10	18	29	n. 61 w.	12
Miles City, Mont	20	16	13	23	n. 68 w.	11
Helena, Mont	8	20	4	42	s. 72 w.	40
Kalispell, Mont	3	22	8	38	s. 58 w.	36
Rapid City, S. Dak	25	12	14	21	n. 28 w.	15
Cheyenne, Wyo	23	13	8	25	n. 60 w.	20
Lander, Wyo	14	23	11	25	s. 57 w.	17
North Platte, Nebr	18	14	13	25	n. 72 w.	13
Middle Slope.						
Denver, Colo	24	19	13	18	n. 45 w.	7
Pueblo, Colo	24	13	18	18	n.	11
Concordia, Kans	26	21	8	14	n. 50 w.	8
Dodge, Kans	22	19	13	17	n. 53 w.	5
Wichita, Kans	25	26	12	11	s. 45 e.	1
Oklahoma, Okla	22	27	7	13	s. 50 w.	8
Southern Slope.						
Abilene, Tex	13	31	17	13	s. 13 e.	18
Amarillo, Tex	16	30	10	18	s. 30 w.	16
Southern Plateau.						
El Paso, Tex	15	10	18	29	n. 66 w.	12
Santa Fe, N. Mex	12	26	19	22	s. 12 w.	14
Flagstaff, Ariz	8	27	8	34	s. 54 w.	32
Phoenix, Ariz	15	11	21	22	n. 14 w.	4
Yuma, Ariz	17	16	9	29	n. 87 w.	20
Independence, Cal	18	20	12	24	s. 81 w.	12
Middle Plateau.						
Carson City, Nev	10	18	6	36	s. 75 w.	31
Winnemucca, Nev	22	16	12	27	n. 68 w.	16
Modena, Utah	7	20	11	32	s. 50 w.	25
Salt Lake City, Utah	23	21	18	15	n. 56 e.	4
Grand Junction, Colo	18	17	23	16	n. 82 e.	7
Northern Plateau.						
Baker City, Oreg	20	24	20	16	s. 45 e.	6
Boise, Idaho	17	16	17	24	n. 82 w.	7
Lewiston, Idaho †	3	11	17	5	s. 56 e.	14
Pocatello, Idaho	3	25	18	23	s. 13 w.	23
Spokane, Wash	11	25	14	22	s. 30 w.	16
Walla Walla, Wash	8	35	11	14	s. 6 w.	27
North Pacific Coast Region.						
North Head, Wash	16	21	12	26	s. 70 w.	15
Port Crescent, Wash.*	7	2	7	19	n. 67 w.	13
Seattle, Wash	16	22	22	17	s. 40 e.	8
Tacoma, Wash	15	24	5	27	s. 68 w.	24
Tatoosh Island, Wash	9	19	14	28	s. 54 w.	17
Portland, Oreg	14	21	11	30	s. 70 w.	20
Roseburg, Oreg	26	9	19	23	n. 13 w.	18
Middle Pacific Coast Region.						
Eureka, Cal	35	12	13	12	n. 2 e.	23
Mount Tamalpais, Cal	33	7	2	35	n. 51 w.	42
Red Bluff, Cal	25	17	17	15	n. 14 e.	8
Sacramento, Cal	15	29	20	11	s. 33 e.	17
San Francisco, Cal	12	9	5	42	n. 85 w.	37
Point Reyes Light, Cal.*	18	4	1	19	n. 52 w.	23
South Pacific Coast Region.						
Fresno, Cal	38	4	4	38	n. 45 w.	48
Los Angeles, Cal	12	17	17	25	s. 58 w.	9
San Diego, Cal	21	15	10	32	n. 75 w.	23
San Luis Obispo, Cal	16	11	1	34	n. 81 w.	33
West Indies.						
Basseterre, St. Kitts, W. I						
Bridgetown, Barbados	4	12	53	0	s. 82 e.	54
Grand Turk, W. I.†	10	6	16	3	n. 73 e.	14
Hamilton, Bermuda	15	20	10	25	s. 72 w.	16
Havana, Cuba †	7	4	17	5	n. 76 e.	12
Puerto Principe, Cuba						
San Juan, Porto Rico	14	22	32	4	s. 74 e.	29

* From observations at 8 p. m. only. † From observations at 8 a. m. only.

TABLE IV.—*Thunderstorms and auroras, April, 1903.*

States.	No. of stations.		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Total. No.	Total. Days.	
Alabama	52	T.			2				2	7			1	7	7						4	5				1	5							41	10	T.
		A.																																0	0	A.
Arizona	56	T.								2	1								5															8	3	T.
		A.																																0	0	A.
Arkansas	57	T.					1	3	14	5	4	4	3	9	7					9	4					7	3			5	8			86	15	T.
		A.																																0	0	A.
California	167	T.	5	1							1				1			7	5											1		1		22	8	T.
		A.																																0	0	A.
Colorado	81	T.	1	2				2		1	6		1	3			4	2	2	2	3		3		1	3	6	9	2	5	1			59	20	T.
		A.																																0	0	A.
Connecticut	21	T.																																0	0	T.
		A.																																0	0	A.
Delaware	5	T.								1	1					4																		6	3	T.
		A.																																0	0	A.
Dist. of Columbia	4	T.								1	1			1																				3	3	T.
		A.																																0	0	A.
Florida	47	T.								5	3			8	16	6				1	5	3					3	5						55	10	T.
		A.																																0	0	A.
Georgia	55	T.			1					18				3	3						1	1					3							30	7	T.
		A.																																0	0	A.
Idaho	34	T.								1	2								2			1						1	1	1				9	7	T.
		A.																																0	0	A.
Illinois	92	T.	10	10	11	1		2	4	5	2	20	21	32	4	1				1	13	2	1		2	5					1			148	20	T.
		A.																		1						1								2	2	A.
Indiana	58	T.	2	9	14	2		3	2	4			17	26	7						7	5	1			10	1					1		111	16	T.
		A.																																0	0	A.
Indian Territory	11	T.									1			1												2					2			6	4	T.
		A.																																0	0	A.
Iowa	149	T.	21	3					1			20	22	21					1	16	3	1		1	2	1			4	33	14			164	16	T.
		A.																																0	0	A.
Kansas	77	T.		3	1				1	1	5	2		2	1			1	2	5	2		1		5	2			1	6	5	1		47	19	T.
		A.																																0	0	A.
Kentucky	41	T.			5			1	6	9	1		7	11	9				1		12	6	3			2								73	13	T.
		A.																																0	0	A.
Louisiana	46	T.							1	2		1	2	1						3	1						1	1			7	2		22	11	T.
		A.																																0	0	A.
Maine	19	T.					1	1														1						2						5	4	T.
		A.					1																											1	1	A.
Maryland	48	T.	1	2	1				6	12			2	13	2	19	1				2	3		1										65	13	T.
		A.																																0	0	A.
Massachusetts	48	T.		1	2												1																	4	3	T.
		A.					1																											1	1	A.
Michigan	106	T.	10	38	2			2				4	19	15	8	2					2					5								107	11	T.
		A.																										1						1	1	A.
Minnesota	67	T.	6	1								9	8	3					1	2	1				8	1			2	9	7			58	13	T.
		A.																																0	0	A.
Mississippi	44	T.							8	3		1	3	4	6			1			1						1							28	9	T.
		A.																																0	0	A.
Missouri	95	T.		14	17				14	4	11	49	19	22	10	2	1		1	21	53	7			9	16	6	1	3	5	12	4		301	23	T.
		A.		1																											1			2	2	A.
Montana	40	T.	1								2	2					1	1		1				1				1				2		12	9	T.
		A.						2																										2	1	A.
Nebraska	142	T.	2		1		1				6	12						2	8	23	7	1			2			1	20	34	8	2		130	16	T.
		A.																																0	0	A.
Nevada	40	T.	1								1																							2	2	T.
		A.																																0	0	A.
New Hampshire	19	T.																																0	0	T.
		A.																																0	0	A.
New Jersey	51	T.				1			4	11	5					7	2																	30	6	T.
		A.																																0	0	A.
New Mexico	31	T.	1								1			1									2		1	2		5	2					15	8	T.
		A.																																0	0	A.
New York	99	T.		13	27	2			14	1	2																							59	6	T.
		A.																										1		1				2	2	A.
North Carolina	56	T.			2	2			2	4				15	14	21					3	15	2	13	1	1	4	7				1		107	16	T.
		A.																																0	0	A.
North Dakota	48	T.									1	9	1	1				1	1	1					2									17	8	T.
		A.																																0	0	A.
Ohio	128	T.	1	8	29					4			32	53	3						4					3	3					1		141	11	T.
		A.																																0	0	A.
Oklahoma	23	T.	2	6					2		16	2		2						2					2	11	2		2	8	22			79	13	T.
		A.										1																						1	1	A.
Oregon	74	T.														1			6								2							9	3	T.
		A.																																0	0	A.
Pennsylvania	91	T.		9	10	2			19	3	10			7	1																			61	8	T.
		A.																																0	0	A.
Rhode Island	7	T.										1																						1	1	T.
		A.																																0	0	A.
South Carolina	46	T.			3				1	9			1	10	14	2					4	11	2				8	6						71	12	T.
		A.																																0	0	A.
South Dakota	56	T.	2	2							2	3	2						2	5	4				2				2	5	2			33	12	T.
		A.																1																1	1	A.
Tennessee	56	T.			8				18	23				18	27	2				1	22	9	11			3	4	1						147	13	T.
		A.																																0	0	A.
Texas	95	T.						1	1	4	4	7	3	3	1			1					1			1	10	1	1	1	25			65	16	T.
		A.																																0	0	A.
Utah	47	T.	5								6	2							2								2	3	1	3				24	8	T.
		A.	1																															1	1	A.
Vermont	16	T.																																0	0	T.
		A.																																0	0	A.
Virginia	50	T.			3				1	4				16	7	7						8					2	2						50	9	T.
		A.																																0	0	A.
Washington	64	T.														4		1						1								1		7	4	T.
		A.																																0	0	A.
West Virginia	43	T.		1	4				7				4	18	4			1			5	1					2	2				1		50	12	T.
		A.																																0	0	A.
Wisconsin	60	T.	22	20				1					7	9	1						2	2	1		1	6				10	3			85	13	T.
		A.																																0	0	A.
Wyoming	31	T.	1										1				5		4		1		3					6	3					24	8	T.
		A.																																0	0	A.
Sums	2893	T.	94	143	143	10	3	16	128	144	95	148	176	335	154	77	15	24	37	93	166	82	31	17	38	82	68	54	44	126	117	17	0	2677	....	T.
		A.	1	1	0	0	2	2	0	0	0	1	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	2	0	1	1	0	0	14	....	A.

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, for storms in which the rate of fall equaled or exceeded 0.25 in any 5 minutes, or 0.75 in 1 hour during April, 1903, at all stations furnished with self-registering gages.*

Stations.	Date.	Total duration.		Total amount of precipitation.	Excessive rate.		Amount before excessive began.	Depths of precipitation (in inches) during periods of time indicated.													
		From—	To—		Began—	Ended—		5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Albany, N. Y	15			0.12														0.07			
Alpena, Mich	13-15			0.81														*			
Asheville, N. C	8			1.14														0.49			
Atlanta, Ga	8	D. N.	8:25 a. m.	1.57	6:45 a. m.	7:00 a. m.	0.90	0.19	0.42	0.56	0.57										
Atlantic City, N. J	13-14			0.63														0.14			
Augusta, Ga	13	11:35 a. m.	12:30 p. m.	1.06	11:55 a. m.	12:20 p. m.	0.17	0.16	0.32	0.52	0.82	0.87	0.89								
Do	25-26	5:35 p. m.	7:50 a. m.	1.04	5:45 p. m.	6:25 p. m.	0.04	0.06	0.28	0.42	0.43	0.45	0.48	0.59	0.70	0.73	0.76	0.79			
Baltimore, Md	13-15			1.66														0.17			
Binghamton, N. Y	3			0.15														0.13			
Bismarck, N. Dak	18			0.24														0.16			
Block Island, R. I	14-15			2.72														0.63			
Boise, Idaho	20			0.20														0.20			
Boston, Mass	15-16			2.18														0.41			
Buffalo, N. Y	3-4			2.04														0.35			
Cairo, Ill	7-8			0.47														0.33			
Charleston, S. C	8			0.34														0.31			
Charlotte, N. C	12-13	9:15 p. m.	6:50 a. m.	1.23	11:49 p. m.	12:35 a. m.	0.09	0.22	0.27	0.27	0.29	0.35	0.46	0.51	0.55	0.72	0.74				
Chattanooga, Tenn	8	2:16 a. m.	5:38 a. m.	1.01	3:14 a. m.	3:55 a. m.	0.02	0.05	0.15	0.27	0.32	0.43	0.59	0.82	0.91	0.93	0.96				
Chicago, Ill	10-11			1.16														0.29			
Cincinnati, Ohio	8			1.02														0.27			
Cleveland, Ohio	3			1.50														0.35			
Columbia, Mo	19-20			1.39														0.56			
Columbia, S. C	25-26			1.51														0.51			
Columbus, Ohio	8			0.82														0.18			
Corpus Christi, Tex	29			0.78														0.61			
Davenport, Iowa	12			0.32														0.30			
Denver, Colo	2-3			0.29														*			
Des Moines, Iowa	18			0.50														*			
Detroit, Mich	11-12	9:30 p. m.	2:00 a. m.	1.22	11:25 p. m.	11:40 p. m.	0.53	0.10	0.37	0.49	0.52	0.54	0.56								
Dodge, Kans	28-29			1.49														*			
Dubuque, Iowa	12			0.39														0.31			
Duluth, Minn	5-6			0.57														0.14			
Eastport, Me	8-9			1.04														0.16			
Elkins, W. Va	3-4			0.77														0.28			
Erie, Pa	3-4			1.56														0.33			
Escanaba, Mich	2			0.27														0.14			
Evansville, Ind	12-13	8:50 p. m.	10:42 a. m.	1.06	9:05 p. m.	9:35 p. m.	0.02	0.32	0.34	0.34	0.44	0.68	0.75	0.78	0.81						
Fort Smith, Ark	7			0.16														0.10			
Fort Worth, Tex	10			0.58														0.21			
Galveston, Tex	29			1.09														0.41			
Grand Haven, Mich	11	3:50 p. m.	8:15 p. m.	1.18	6:20 p. m.	7:04 p. m.	0.18	0.10	0.33	0.49	0.50	0.51	0.55	0.65	0.82	0.88					
Grand Junction, Colo	1-2			0.40														0.10			
Green Bay, Wis	24			0.58														*			
Harrisburg, Pa	13-15			1.88														0.17			
Hatteras, N. C	22			0.85														0.49			
Huron, S. Dak	18-19			0.77														0.25			
Indianapolis, Ind	24			0.33														0.31			
Jacksonville, Fla	13	5:30 p. m.	8:30 p. m.	1.01	6:21 p. m.	7:15 p. m.	0.01	0.09	0.30	0.46	0.70	0.72	0.72	0.72	0.72	0.76	0.91	0.98			
Jupiter, Fla	8			0.31														0.14			
Kalispell, Mont	7			0.09														0.07			
Kansas City, Mo	2-3			1.36														0.27			
Key West, Fla	26			0.44														0.42			
Knoxville, Tenn	7-8	D. N.	6:25 a. m.	1.64	4:20 a. m.	4:55 a. m.	0.60	0.13	0.35	0.47	0.51	0.57	0.62	0.68	0.70						
La Crosse, Wis	1-2			1.21					0.33												
Lewiston, Idaho	8-9			0.45														0.05			
Lexington, Ky	12-13			1.10														*			
Lincoln, Nebr	28-29	5:30 p. m.	7:10 a. m.	2.16	7:50 p. m.	8:05 p. m.	0.21	0.18	0.44	0.55	0.58	0.60									
Little Rock, Ark	7	7:00 a. m.	10:00 a. m.	0.71	8:00 a. m.	8:15 a. m.	0.08	0.14	0.36	0.43	0.44										
Los Angeles, Cal	16-17			3.00														0.49			
Louisville, Ky	19-20			1.91										0.47							
Lynchburg, Va	7-8			0.90														0.19			
Macon, Ga	13	8:05 p. m.	10:35 p. m.	0.55	10:05 p. m.	10:25 p. m.	0.04	0.17	0.37	0.43	0.49	0.51									
Memphis, Tenn	12	7:10 a. m.	9:45 a. m.	1.14	7:59 a. m.	8:25 a. m.	0.03	0.35	0.57	0.62	0.72	0.87	0.91	0.93	0.96						
Meridian, Miss	13	6:00 a. m.	8:18 a. m.	0.86	7:50 a. m.	8:10 a. m.	0.03	0.12	0.34	0.58	0.83										
Milwaukee, Wis	12			0.33														0.29			
Montgomery, Ala	13			1.08														0.49			
Nantucket, Mass	15			0.71														0.38			
Nashville, Tenn	8	D. N.	4:30 a. m.	1.68	1:05 a. m.	1:45 a. m.	0.08	0.10	0.25	0.36	0.40	0.44	0.47	0.69	0.85	0.87	0.94	1.01			
New Haven, Conn	7-8			0.97														0.36			
New Orleans, La	30	7:57 a. m.	11:15 a. m.	0.97	9:32 a. m.	10:03 a. m.	0.26	0.12	0.27	0.34	0.47	0.60	0.66	0.68							
New York, N. Y	4			0.60														0.20			
Norfolk, Va	14-15			1.81														0.53			
Northfield, Vt	7			0.12														0.12			
North Head, Wash	20-21			1.22														0.20			
Oklahoma, Okla	29			0.44														0.30			
Omaha, Nebr	28-29			1.19														0.30			
Palestine, Tex	29			0.65														0.20			
Parkersburg, W. Va	13			1.01														0.55			
Pensacola, Fla	6			0.08														0.08			
Philadelphia, Pa	14-15			1.28														0.21			
Pittsburg, Pa	8			0.72														0.27			
Pocatello, Idaho	10			0.40														*			
Portland, Me	15-16			1.38														0.18			
Portland, Oreg	3			0.20														0.19			
Pueblo, Colo	2			0.25														0.11			
Raleigh, N. C	14			0.89														0.82†			
Richmond, Va	13-14			1.22														0.43			
Rochester, N. Y	3-4			1.60														0.34			
Sacramento, Cal	1			0.25														0.13			
St. Louis, Mo	3			0.39									0.21								
St. Paul, Minn	28-29			1.23														0.45			
Salt Lake City, Utah	26-27			0.49														0.20			
San Antonio, Tex	29			1.68														0.58			
San Diego, Cal	16-17			1.00														*			
Sandusky, Ohio	2-3			1.81														0.20			
San Francisco, Cal	1			0.39														0.29			
Savannah, Ga	19			0.53														0.45			
Scranton, Pa	7			0.47														0.43			
Seattle, Wash	21			0.51														0.16			
Shreveport, La	29	4:10 p. m.	10:00 p. m.	1.38	4:13 p. m.	4:37 p. m.	T.	0.15	0.37	0.68	0.75	0.82									
Spokane, Wash	26			0.13														0.12			

TABLE V.—*Accumulated amounts of precipitation for each 5 minutes, etc.*—Continued.

Stations.	Date.	Total duration. From—	Total duration. To—	Total amount of precipitation.	Excessive rate. Began—	Excessive rate. Ended—	Amount before excessive began.	5 min.	10 min.	15 min.	20 min.	25 min.	30 min.	35 min.	40 min.	45 min.	50 min.	60 min.	80 min.	100 min.	120 min.
	1	2	3	4	5	6	7														
Springfield, Ill	10-11			1.68														0.33			
Springfield, Mo	12-13			1.27														0.43			
Tampa, Fla	9	2:12 p. m.	5:10 p. m.	0.58	3:07 p. m.	3:20 p. m.	0.03	0.12	0.32	0.51											
Taylor, Tex.	29			0.70														0.31			
Toledo, Ohio	3-4			1.44														0.31			
Topeka, Kan	18	5:20 p. m.	7:05 p. m.	0.61	5:30 p. m.	5:45 p. m.	0.01	0.06	0.26	0.52	0.56										
Valentine, Nebr	18			0.39														0.19			
Vicksburg, Miss	30			0.98														*			
Washington, D. C	13-15			2.01														0.34			
Wichita, Kans	29			1.72														0.39			
Wilmington, N. C.	20	12:35 p. m.	1:55 p. m.	0.82	1:01 p. m.	1:53 p. m.	0.02	0.21	0.41	0.44	0.49	0.49	0.49	0.50	0.53	0.65	0.77	0.80			
Wytheville, Va	3-4			0.58														0.37			
Yankton, S. Dak	28			0.80														*			
Bridgetown, Barbados	4			0.23														0.21			
Havana, Cuba	14-15			0.39														0.16			
San Juan, Porto Rico	20	10:47 a. m.	11:35 a. m.	0.73	10:50 a. m.	11:10 a. m.	0.02	0.16	0.34	0.55	0.67	0.70									

*Self-register not working. †Estimated.

TABLE VI.—*Data furnished by the Canadian Meteorological Service, April, 1903.*

Stations.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Pressure. Sea level, reduced to mean of 24 hours.	Pressure. Departure from normal.	Temperature. Mean.	Temperature. Departure from normal.	Temperature. Mean maximum.	Temperature. Mean minimum.	Precipitation. Total.	Precipitation. Departure from normal.	Precipitation. Depth of snow.	Stations.	Pressure, in inches. Actual, reduced to mean of 24 hours.	Pressure. Sea level, reduced to mean of 24 hours.	Pressure. Departure from normal.	Temperature. Mean.	Temperature. Departure from normal.	Temperature. Mean maximum.	Temperature. Mean minimum.	Precipitation. Total.	Precipitation. Departure from normal.	Precipitation. Depth of snow.
	Ins.	Ins.	Ins.	°	°	°	°	Ins.	Ins.	Ins.		Ins.	Ins.	Ins.	°	°	°	°	Ins.	Ins.	Ins.
St. Johns, N. F	29.71	29.85	—.04	35.1	+ 0.6	41.6	28.6	5.07	+0.91	0.2	Parry Sound, Ont	29.23	29.93	—.09	42.1	+ 4.5	53.4	30.8	1.88	—0.03	T.
Sydney, C. B. I	29.85	29.89	.00	37.0	+ 2.0	44.5	29.5	6.37	+2.52	3.5	Port Arthur, Ont	29.28	30.00	—.03	35.2	+ 1.7	43.9	26.6	1.81	+0.09	15.8
Halifax, N. S	29.78	29.89	—.07	40.6	+ 2.8	48.6	32.5	5.52	+1.34	1.1	Winnipeg, Man	29.15	30.00	—.02	40.0	+ 4.1	52.6	27.4	0.54	—0.51	0.4
Grand Manan, N. B	29.80	29.85	—.09	41.2	+ 2.0	48.5	34.0	5.36	+2.40	4.5	Minnedosa, Man	28.15	30.00	—.01	39.6	+ 3.6	52.1	27.1	1.05	—0.01	7.9
Yarmouth, N. S	29.81	29.88	—.08	41.5	+ 2.6	48.5	34.6	6.15	+2.76	4.1	Qu'Appelle, Assin	27.65	29.91	—.08	40.2	+ 2.8	53.9	26.5	0.39	—0.66	2.3
Charlottetown, P. E. I	29.84	29.88	—.02	36.6	+ 1.4	43.7	29.5	4.37	+1.72	10.3	Medicine Hat, Assin	27.56	29.85	—.07	44.1	— 0.4	58.3	29.9	0.45	—0.29	1.0
Chatham, N. B	29.83	29.85	—.05	37.9	+ 2.4	47.9	27.9	3.80	+1.17	15.6	Swift Current, Assin	27.33	29.91	—.05	42.3	+ 1.0	54.7	29.8	0.85	—0.08	3.6
Father Point, Que	29.85	29.87	—.06	34.9	+ 1.7	42.1	27.7	3.05	+1.47	20.2	Calgary, Alberta	26.29	29.86	—.04	37.5	— 2.1	49.1	25.9	0.46	—0.18	2.6
Quebec, Que	29.57	29.90	—.09	39.1	+ 4.0	47.4	30.9	1.76	—0.33	5.1	Banff, Alberta	25.26	29.92	+.02	32.3	— 3.0	42.1	22.5	1.07	—0.01	6.5
Montreal, Que	29.69	29.90	—.10	44.1	+ 4.4	53.1	35.1	2.22	—0.02	4.3	Edmonton, Alberta	27.57	29.89	.00	37.8	— 2.1	48.5	27.0	1.20	+0.32	10.7
Bissett, Ont	29.35	29.97	—.05	40.3	+ 2.4	54.7	25.9	1.12	—0.44	1.0	Prince Albert, Sask	28.35	29.93	—.05	33.7	— 2.4	46.3	21.2	1.41	—0.58	13.0
Ottawa, Ont	29.65	29.98	—.04	44.1	+ 4.1	55.0	33.3	0.95	—0.55	1.0	Battleford, Sask	28.19	29.96	—.01	36.2	— 1.0	47.8	24.5	1.15	+0.68	6.9
Kingston, Ont	29.60	29.92	—.10	42.3	+ 2.3	50.8	33.8	3.22	+1.43	1.1	Kamloops, B. C	28.68	29.90	—.03	47.0	— 1.9	57.9	36.1	0.28	—0.11	0.0
Toronto, Ont	29.55	29.94	—.08	43.9	+ 3.1	52.7	35.0	3.74	+1.37	3.0	Victoria, B. C	29.95	30.05	+.04	46.5	— 0.3	52.7	40.3	1.39	—0.98	0.0
White River, Ont	28.73	30.08	+.04	31.2	— 1.8	43.5	18.9	1.48	+0.23	13.8	Barkerville, B. C	25.59	29.95	+.09	31.3	— 1.8	41.7	20.8	2.86	+1.04	23.0
Port Stanley, Ont	29.28	29.90	—.12	44.2	+ 3.2	51.2	37.1	3.88	+1.41	3.3	Hamilton, Bermuda	29.80	29.96	—.09	66.0	+ 2.1	70.8	61.1	4.20	+0.02	0.0
Saugeen, Ont	29.23	29.95	—.08	42.5	+ 3.8	51.8	33.2	0.95	—0.85	0.3	Dawson City, Yukon										

TABLE VII.—*Heights of rivers referred to zeros of gages, April, 1903.*

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water. Height.	Highest water. Date.	Lowest water. Height.	Lowest water. Date.	Mean stage.	Monthly range.
Mississippi River.	Miles.	Feet.	Feet.		Feet.		Feet.	Feet.
St. Paul, Minn	1,954	14	8.9	18	6.9	6, 10	7.6	2.0
Red Wing, Minn	1,914	14	8.2	18	6.6	9, 28, 30	7.2	1.6
Reeds Landing, Minn.	1,884	12	7.2	18, 19	5.9	28	6.4	1.3
La Crosse, Wis	1,819	12	8.6	1, 19-22	7.4	11	8.1	1.2
Prairie du Chien, Wis	1,759	18	11.8	1	8.5	30	9.4	3.3
Dubuque, Iowa	1,699	15	12.8	1, 2	9.6	30	10.6	3.2
Leclaire, Iowa	1,609	10	8.0	3, 4	5.9	30	6.9	2.1
Davenport, Iowa	1,593	15	10.4	4	8.1	30	9.3	2.3
Muscatine, Iowa	1,562	16	12.0	4, 5	9.6	30	11.1	2.4
Galland, Iowa	1,472	8	6.4	14, 16-18	5.0	30	5.9	1.4
Keokuk, Iowa	1,463	15	11.7	11	8.9	30	10.7	2.8
Hannibal, Mo.	1,402	13	14.2	12	10.2	30	12.2	4.0
Grafton, Ill.	1,306	23	18.8	15	15.3	2, 3	17.0	3.5
St. Louis, Mo	1,264	30	24.6	18	19.0	30	21.9	5.6
Chester, Ill	1,189	30	20.8	19	16.1	4, 30	18.4	4.7
New Madrid, Mo.	1,003	34	35.2	24-26	28.9	9-11	32.3	6.3
Memphis, Tenn[1]	843	33	36.0	1	28.5	12-14	31.9	7.5
Helena, Ark.	767	42	49.9	1	41.1	16	44.1	8.8
Arkansas City, Ark.	635	42	52.3	1	45.1	24-28	47.8	7.2
Greenville, Miss.	595	42	46.6	1	39.2	25-27	42.0	7.4
Vicksburg, Miss.	474	45	51.3	1	45.1	30	48.5	6.2
New Orleans, La.	108	16	20.4	6, 7	18.5	29	19.6	1.9
Yellowstone River.								
Glendive, Mont.	98	17	7.2	3	0.3	29, 30	2.1	6.9
James River.								
Lamoure, N. Dak.		25	6.5	5-7	—1.6	30	1.7	8.1
Huron, S. Dak	210	9	2.9	20	1.9	8, 11, 13-15	2.3	1.0
Missouri River.								
Townsend, Mont.	2,504	10	5.2	29	4.1	7-10	4.5	1.1
Fort Benton, Mont.	2,285	12	2.7	30	1.5	9-11	2.0	1.2
Bismarck, N. Dak.	1,309	14	12.4	6	2.2	29, 30	3.8	10.2
Pierre, S. Dak.	1,114	14	10.2	8	2.5	1	4.0	7.7
Sioux City, Iowa	784	19	11.7	11	6.8	1	8.1	4.9
Missouri River—Cont'd.	Miles.	Feet.	Feet.		Feet.		Feet.	Feet.
Omaha, Nebr.	669	18	12.0	13	7.8	1, 2	8.6	4.2
Plattsmouth, Nebr.			7.9	13	3.9	11	5.0	4.0
St. Joseph, Mo.	481	10	7.3	14	3.2	11	3.9	4.1
Kansas City, Mo.	388	21	14.0	15	8.6	30	10.4	5.4
Glasgow, Mo.	231		9.6	16	4.9	29, 30	6.8	4.7
Boonville, Mo.	199	20	14.0	16	8.8	30	11.2	5.2
Hermann, Mo.	103	24	14.7	17	8.2	30	11.5	6.5
Chippewa River.								
Chippewa Falls, Wis.	90	16	7.0	30	3.0	13, 18, 19, 22-24, 26	3.8	4.0
Illinois River.								
Peoria, Ill.	135	14	18.7	19, 20	14.7	6, 7	16.4	4.0
Youghiogheny River.								
Confluence, Pa.	59	10	5.1	16	2.1	7	3.2	3.0
West Newton, Pa.	15	23	7.0	9	1.4	30	3.4	5.6
Allegheny River.								
Warren, Pa.	177	14	7.1	4	1.4	30	3.4	5.7
Oil City, Pa	123	13	8.3	5	1.9	30	4.0	6.4
Parker, Pa.	73	29	8.8	5	1.7	30	4.5	7.1
Freeport, Pa	29	20	13.0	16	4.3	30	7.9	8.7
Clarion River.								
Clarion, Pa.	32	10	5.3	15, 16	1.4	30	3.1	3.9
Monongahela River.								
Weston, W. Va.	161	18	6.6	16	3.4	3, 6, 30	4.2	3.2
Fairmont, W. Va.	119	25	10.8	9	2.8	25-27	4.3	8.0
Greensboro, Pa.	81	18	15.2	9	8.0	30	9.7	7.2
Lock No. 4, Pa.	40	28	17.7	10	7.9	26	10.7	9.8
Conemaugh River.								
Johnstown, Pa.	64	7	6.6	16	2.5	30	3.3	4.1
Red Bank Creek.								
Brookville, Pa.	35	8	2.2	15	0.4	27-30	0.8	1.8
Beaver River.								
Ellwood Junction, Pa.	10	14	6.0	15	3.0	21-30	3.6	3.0

TABLE VII.—*Heights of rivers referred to zeros of gages*—Continued.

Stations.	Distance to mouth of river.	Danger line on gage.	Highest water.		Lowest water.		Mean stage.	Monthly range.
			Height.	Date.	Height.	Date.		
	Miles.	Feet.	Feet.		Feet.		Feet.	Feet.
Great Kanawha, River.								
Charleston, W. Va	58	30	14.0	17	6.8	25	9.3	7.2
Little Kanawha River.								
Glenville, W. Va	103	20	11.4	16	0.5	25	2.7	10.9
New River.								
Radford, Va	155	14	3.0	8, 27	1.2	21, 22	1.9	1.8
Hinton, W. Va	95	14	6.8	27	3.7	20, 25	4.7	3.1
Cheat River.								
Rowlesburg, W. Va.	36	14	6.3	9	1.8	1	3.4	4.5
Ohio River.								
Pittsburg, Pa	966	22	13.4	17	3.3	30	7.8	10.1
Davis Island Dam, Pa	960	25	13.4	17	5.6	30	9.2	7.8
Beaver Dam, Pa	925	27	18.8	17	7.0	30	12.6	11.8
Wheeling, W. Va	875	36	19.5	18	6.9	30	12.9	12.6
Parkersburg, W. Va	785	36	27.0	16, 17	8.0	30	15.6	19.0
Point Pleasant, W. Va	703	39	36.5	17	12.9	30	22.0	23.6
Huntington, W. Va	660	50	41.7	17	18.7	26, 30	27.4	23.0
Catlettsburg, Ky	651	50	43.0	17	19.1	26, 27, 30	28.2	23.9
Portsmouth, Ohio	612	50	43.5	17	20.3	26	29.6	23.2
Cincinnati, Ohio	499	50	44.4	19	22.8	29	32.9	21.6
Madison, Ind	413	46	37.0	18	20.4	30	29.0	16.6
Louisville, Ky	367	28	18.9	20	9.0	30	12.7	9.9
Evansville, Ind	184	35	36.1	21	21.9	9	29.4	14.2
Paducah, Ky	47	40	38.9	23	26.5	9	33.1	12.4
Cairo, Ill	1,073	45	45.2	22-24	36.0	9, 10	40.8	9.2
Muskingum River.								
Zanesville, Ohio	70	20	20.3	15	7.9	30	12.8	12.4
Scioto River.								
Columbus, Ohio	110	17	8.0	15	3.2	26	4.6	4.8
Miami River.								
Dayton, Ohio	77	18	4.7	5	2.0	29, 30	2.9	2.7
Wabash River.								
Mount Carmel, Ill	50	15	20.5	22	6.2	5	13.2	14.3
Licking River.								
Falmouth, Ky	30	25	12.0	13	3.0	30	6.5	9.0
Kentucky River.								
High Bridge, Ky	117	17	19.5	10	12.1	4	14.7	7.4
Frankfort, Ky	65	31	16.3	11	8.0	5	10.6	8.3
Clinch River.								
Speers Ferry, Va	156	20	9.8	14	1.4	3	3.3	8.4
Clinton, Tenn	52	25	21.1	10	8.6	3	12.3	12.5
Hiwassee River.								
Charleston, Tenn	18	22	15.7	9	3.5	30	7.0	12.2
Holston River.								
Rogersville, Tenn	103	14	10.0	9	3.5	25	4.8	6.5
French Broad River.								
Asheville, N. C	144	6	4.3	9	0.9	30	2.1	3.4
Leadvale, Tenn	70	15	14.0	9	2.0	30	4.3	12.0
Tennessee River.								
Knoxville, Tenn	635	29	24.6	9	5.7	30	9.6	18.9
Kingston, Tenn	556	25	23.4	9	6.0	27. 28, 30	10.0	17.4
Chattanooga, Tenn	452	33	31.8	11	9.2	28. 29	16.3	22.6
Bridgeport, Ala	402	24	22.7	12	7.0	29	13.0	15.7
Florence, Ala	255	16	18.0	14, 15	6.6	30	12.3	11.4
Riverton, Ala	225	25	28.3	15	9.1	30	18.9	19.2
Johnsonville, Tenn	95	24	26.9	18	11.6	30	20.4	15.3
Cumberland River.								
Burnside, Ky	516	50	42.6	9	6.7	30	15.0	35.9
Carthage, Tenn	305	40	33.3	10	8.5	30	19.0	24.8
Nashville, Tenn	189	40	34.3	12	13.0	30	23.3	21.3
Clarksville, Tenn	126	42	37.8	14	16.3	30	27.0	21.5
Arkansas River.								
Wichita, Kans	832	10	1.7	3-7	1.4	18-28	1.5	0.3
Webbers Falls, Ind. T	465	23	10.6	13	3.4	29. 30	6.0	7.2
Fort Smith, Ark	403	22	10.3	14	4.1	30	6.6	6.2
Dardanelle, Ark	256	21	10.2	10	4.0	30	7.0	6.2
Little Rock, Ark	176	23	11.6	12	5.6	30	8.9	6.0
White River.								
Newport, Ark	150	26	17.5	1	7.2	30	11.3	10.3
Yazoo River.								
Yazoo City, Miss	80	25	28.7	5-8	22.5	30	26.8	6.2
Red River.								
Arthur City, Tex	638	27	9.2	1	6.2	29, 30	7.3	3.0
Fulton, Ark	515	28	21.0	1	9.2	29	12.3	11.8
Shreveport, La	327	29	30.9	1	6.3	30	16.8	24.6
Alexandria, La	118	33	35.9	1, 2	16.0	30	27.4	19.9
Ouachita River.								
Camden, Ark	304	39	16.2	1	6.8	30	10.0	9.4
Monroe, La	122	40	44.1	1	34.7	30	39.3	9.4
Atchafalaya River.								
Melville, La	100	31	38.7	4, 5	36.9	29, 30	38.0	1.8
Penobscot River.								
Mattawamkeag, Me	87	......	17.0	11	14.7	24-26	15.8	2.3
Montague, Me	60	......	12.3	10	8.3	25	10.1	4.0
Kennebec River.								
Solon, Me.[2]	86	......	......	......	......	......	......	......
Winslow, Me	46	......	6.3	9, 11	3.8	27, 28	5.1	2.5
Merrimac River.								
Franklin Junction, N. H	110	......	9.8	1	5.3	29	7.0	4.5
Concord, N. H	94	......	5.9	1	2.8	28-30	4.2	3.1
Manchester, N. H	68	......	3.7	5	2.0	13, 21, 24	2.6	1.7
Connecticut River.								
Wells River, Vt	255	......	27.0	5, 6	23.0	25-30	24.8	4.0
White River Junction, Vt	209	......	13.2	1	6.9	26	9.8	6.3
Bellows Falls, Vt	170	12	6.0	1	1.9	25	3.8	4.1
Holyoke, Mass	84	9	5.7	2, 5	1.6	30	3.8	4.1
Hartford, Conn	50	13	14.8	10	5.5	30	10.4	9.3
Housatonic River.								
Gaylordsville, Conn	50	15	7.2	10	4.6	28	5.7	2.6
Susquehanna River.								
Binghamton, N. Y	306	16	7.6	1	3.2	30	4.8	4.4
Towanda, Pa	262	16	7.1	1, 15	1.6	30	4.0	5.5
Wilkesbarre, Pa	183	17	14.4	16	4.9	30	8.7	9.5
Harrisburg, Pa	69	17	12.3	17	3.3	30	6.3	9.0
West Branch Susquehanna.								
Lockhaven, Pa	65	12	4.3	16	0.6	30	1.9	3.7
Williamsport, Pa	39	20	11.6	16	2.7	30	5.6	8.9
Juniata River.								
Huntingdon, Pa.	90	24	7.6	16	3.9	30	4.8	3.7
Shenandoah River.								
Riverton, Va	58	22	6.9	16	1.2	29, 30	2.9	5.7
Potomac River.								
Cumberland, Md	290	8	7.2	16	3.3	29, 30	4.6	3.9
Harpers Ferry, W. Va	172	18	14.5	15	3.6	30	7.2	10.9
James River.								
Lynchburg, Va	260	18	5.0	1	2.3	24, 25	3.3	2.7
Richmond, Va	111	12	7.1	15	0.5	25	2.6	6.6
Dan River.								
Danville, Va	55	8	5.4	9	0.2	22	1.4	5.2
Roanoke River.								
Clarksville, Va	196	12	11.0	1	5.4	13	7.0	5.6
Weldon, N. C	129	30	31.0	1, 2	14.5	21	21.6	16.5
Cape Fear River.								
Fayetteville, N. C	112	38	38.8	1	9.3	21	19.1	29.5
Edisto River.								
Edisto, S. C	75	6	5.5	2, 3	4.2	28	4.6	1.3
Pedee River.								
Cheraw, S. C	149	27	27.8	1	7.8	25	15.4	2.0
Black River.								
Kingstree, S. C.[3]	52	12	9.7	3	7.6	30	8.6	2.1
Lynch Creek.								
Effingham, S. C	35	12	10.5	4, 8	5.8	18, 30	8.3	4.7
Santee River.								
St. Stephens, S. C	97	12	15.2	1	8.5	30	10.4	6.7
Congaree River.								
Columbia, S. C	37	15	16.6	1	2.5	30	5.6	14.1
Wateree River.								
Camden, S. C.[2]	45	24	......	......	......	......	......	......
Waccamaw River.								
Conway, S. C	40	7	6.9	4, 5	4.1	30	5.6	2.8
Savannah River.								
Calhoun Falls, S. C	347	15	12.9	14	3.8	29, 30	4.9	9.1
Augusta, Ga	268	32	24.9	1	10.7	30	14.6	14.2
Broad River.								
Carlton, Ga	30	11	6.8	14	3.2	30	3.9	3.6
Flint River.								
Albany, Ga	80	20	14.6	2	7.1	29	10.8	7.5
Chattahoochee River.								
Oakdale, Ga	305	18	16.8	15	4.7	29, 30	7.1	12.1
Westpoint, Ga	239	20	12.3	1	4.5	30	6.6	7.8
Eufaula, Ala	90	40	27.9	1	6.0	30	13.4	21.9
Ocmulgee River.								
Hollingsworth Ferry, Ga	172	8	13.0	1	5.6	30	9.7	7.4
Macon, Ga	125	18	14.3	1	5.4	30	8.1	8.9
Oconee River.								
Dublin, Ga	79	20	15.5	3	3.6	30	8.5	11.9
Coosa River.								
Rome, Ga	271	30	24.9	1	3.7	30	8.5	21.2
Gadsden, Ga	144	18	20.8	3, 4	4.4	30	11.0	16.4
Alabama River.								
Montgomery, Ala	265	35	29.5	2, 3	7.1	30	17.2	22.4
Selma, Ala	212	35	31.4	3, 4	9.8	30	20.5	21.6
Tombigbee River.								
Columbus, Miss.[1]	303	33	3.6	16, 17	− 0.2	30	2.0	3.8
Demopolis, Ala	155	35	21.3	1	7.6	30	14.7	13.7
Black Warrior River.								
Tuscaloosa, Ala	90	43	32.1	15	8.9	30	15.8	23.2
Brazos River.								
Kopperl, Tex	369	21	0.6	1-17	− 0.8	30	0.3	1.4
Waco, Tex	301	24	5.4	1, 2	3.3	28-30	4.0	2.1
Booth, Tex	76	39	15.5	10	9.3	27, 28	11.4	6.2
Red River of the North.								
Moorhead, Minn	418	26	13.9	6	8.5	30	10.6	5.4
Columbia River.								
Umatilla, Oreg	270	25	10.6	30	6.4	17, 18	7.8	4.2
The Dalles, Oreg	166	40	16.0	30	9.4	18, 19	11.7	6.6
Willamette River.								
Albany, Oreg	118	20	6.0	1	3.3	21	4.4	2.7
Portland, Oreg	12	15	9.1	30	4.9	20, 21	7.0	4.2
Sacramento River.								
Red Bluff, Cal	265	23	11.8	1	4.1	29, 30	6.0	7.7
Sacramento, Cal	64	29	27.6	4	21.0	27	23.8	6.6

([1]) 29 days only. ([2]) No observations taken. ([3]) Interpolated readings.

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physico-Geographic Institute.

TABLE 1.—*Hourly observations at the Observatory, San José de Costa Rica, during April, 1903.*

Hours.	Pressure.		Temperature.		Relative humidity.		Rainfall.		
	Observed, 1903.	Normal, 1889-1900.	Observed, 1903.	Normal, 1889-1900.	Observed, 1903.	Normal, 1889-1900.	Observed, 1903.	Normal, 1889-1900.	Duration, 1903.
	Inches.	*Inches.*	° *F.*	° *F.*	%	%	*Ins.*	*Ins.*	*Hrs.*
1 a. m	26.16	26.15	62.7	63.5	79	84	T.	0.02	1.00
2 a. m	26.14	26.13	62.1	63.1	79	85	0.00	0.01	0.00
3 a. m	26.13	26.12	61.2	62.6	80	85	T.	0.00	0.67
4 a. m	26.12	26.11	60.6	62.4	80	85	0.01	0.01	1.00
5 a. m	26.12	26.11	60.1	62.2	80	84	0.01	T.	1.00
6 a. m	26.11	26.13	59.7	62.0	79	86	0.00	T.	0.00
7 a. m	26.14	26.14	60.1	62.8	80	82	0.00	T.	0.00
8 a. m	26.16	26.16	65.1	67.8	64	75	0.00	0.01	0.00
9 a. m	26.17	26.16	70.6	71.4	51	68	0.00	0.01	0.00
10 a. m	26.17	26.17	74.7	74.3	51	61	0.03	T.	0.45
11 a. m	26.16	26.16	77.2	76.8	43	54	0.02	0.01	1.17
Noon	26.15	26.15	79.5	77.9	42	57	T.	0.03	0.33
1 p. m	26.13	26.13	80.4	79.1	46	54	0.00	0.06	0.00
2 p. m	26.11	26.11	80.0	78.9	43	55	0.01	0.13	0.50
3 p. m	26.09	26.09	79.3	76.5	45	61	0.03	0.32	1.00
4 p. m	26.09	26.08	77.0	74.3	54	65	0.05	0.19	1.00
5 p. m	26.09	26.09	73.4	71.5	59	71	0.01	0.23	1.00
6 p. m	26.10	26.10	70.3	69.5	66	75	0.05	0.17	0.33
7 p. m	26.12	26.12	67.9	67.5	74	79	0.02	0.21	1.00
8 p. m	26.12	26.13	66.6	66.3	76	82	0.02	0.08	1.50
9 p. m	26.15	26.15	65.5	65.8	79	82	0.31	0.05	1.00
10 p. m	26.16	26.16	64.7	64.9	80	84	0.24	0.05	1.50
11 p. m	26.17	26.17	63.8	64.2	79	84	0.13	0.06	2.00
Midnight	26.17	26.16	63.1	63.8	79	85	0.04	0.03	2.50
Mean	26.14	26.13	68.5	68.7	66	74			
Minimum	26.02	26.00	53.6	51.4	8				
Maximum	26.22	26.26	88.9	94.5	100				
Total							0.98	1.68	18.95

REMARKS.—At San José the barometer is 1,169 meters above sea level. Readings are corrected for gravity, temperature, and instrumental error. The hourly readings for pressure, and wet and dry bulb thermometers, are obtained by means of Richard registering instruments, checked by direct observations every three hours from 7 a. m. to 10 p. m. The thermometers are 1.5 meters above ground and are corrected for instrumental errors. The total hourly rainfall is as given by Hottinger's self-register, checked once a day. Under maximum, the greatest hourly rainfall for the month is given. The standard rain gage is 1.5 meters above ground. Since January 1, 1902, observations at San José have been made on seventy-fifth meridian time, which is 0 hours, 36 minutes, 13.3 seconds *in advance* of San José local time. The normals for pressure, temperature, and relative humidity have been adjusted to this time; the normal for rainfall in Table 1 and the sunshine observations and normal in Table 2 refer to local time. At Port Limon the hours of direct observation are 8 a. m., 2 and 8 p. m., San José local time; the barometer is 3.4 meters above sea level. The means for temperature and relative humidity in Table 4 are obtained from two-hourly readings given by a Richard self-registering thermometer.

TABLE 2.—*San José, April, 1903.*

Time.	Sunshine.		Cloudiness.		Temperature of the soil at depth of—				
	Observed, 1903.	Normal, 1889-1900.	Observed, 1903.	Normal, 1889-1900.	6 inches.	12 inches.	24 inches.	48 inches.	120 inches.
	Hours.	*Hours.*	%	%	° *F.*	° *F.*	° *F.*	° *F.*	° *F.*
7 a. m	17.08	13.16	37	46	71.6	72.7	73.4	71.6	70.9
8 a. m	26.23	21.78							
9 a. m	26.78	22.14							
10 a. m	25.26	21.84	57	53	71.8	72.5	73.4	71.8	
11 a. m	24.63	21.57							
Noon	22.28	20.09							
1 p. m	22.07	19.81	61	63	73.2	72.9	73.4	71.6	
2 p. m	21.98	19.25							
3 p. m	23.15	16.80							
4 p. m	20.40	13.34	63	76	74.2	73.6	73.4	71.6	
5 p. m	16.41	9.84							
6 p. m	8.73	4.95							
7 p. m			59	70	74.1	73.6	73.5	71.6	
8 p. m									
9 p. m									
10 p. m			36	59	73.5	73.5	73.5	71.6	
11 p. m									
Midnight									
Mean			52	61	73.0	73.0	73.5	71.6	70.9
Total	255.00	204.57							

TABLE 3.—*Rainfall at stations in Costa Rica, April, 1903.*

Stations.	Height above sea level.	Observed, 1903.		Averages.		
		Amount.	Number of days.	Number of years.	Amount.	Number of days.
	Feet.	*Inches.*			*Inches.*	
Sipurio (Talamanca)	197			2	10.82	17
Boca Banano	10	9.25	9	7	16.06	20
Port Limon	10	12.28	6	7	10.39	14
Swamp Mouth	10	11.97	10	4	11.69	16
Zent	66	13.74	11	1	9.68	13
Siquirres	197	14.88	9	3	12.52	17
Dos Novillos	400					
Guapiles	984	8.07	7	2	13.86	18
Cariblanco (Sarapiqui)	2,740			5	10.78	20
San Carlos	328	3.07	8	4	5.99	19
Las Lomas	873	8.93	6	2	10.47	13
Peralta	1,089	7.13	7	5	8.89	14
Turrialba	2,034	1.61	7	7	7.68	12
Juan Viñas	3,412	3.35	8	5	4.85	10
Santiago	3,609	10.03	10	2	9.01	14
Paraiso	4,383	0.55	8	1	4.25	15
Cachi	3,346	3.19	7	1	3.23	16
Las Concavas	4,386	2.95	7	1	4.09	22
Tres Rios	4,265	0.67	3	14	2.05	5
San Isidro Arenilla						
San Francisco Guadalupe	3,894	2.87	6	7	2.09	7
San Jose	3,806	0.98	4	14	1.50	7
La Verbena	3,740	1.06	5	5	1.18	4
Nuestro Amo	2,595	0.00	0	4	1.22	5
Alajuela	3,117			2	2.56	6
San Isidro Alajuela	4,416	0.55	3	2	3.23	7

TABLE 4.—*Observations taken at Port Limon and Zent, April, 1903.*

Stations.	Pressure.			Temperature.			Relative humidity.
	Minimum.	Maximum.	Mean.	Minimum.	Maximum.	Mean.	
	Inches.	*Inches.*	*Inches.*	° *F.*	° *F.*	° *F.*	%
Port Limon	29.69	30.07	29.84	62.6	86.0	75.9	81
Zent				50.9	95.0	77.4	83

Stations.	Cloudiness.	Sunshine.	Rainfall.		Temperature of soil at depth of—		
			Amount.	Number of days.	6 inches.	12 inches.	24 inches.
	%	*Hours.*	*Inches.*		° *F.*	° *F.*	° *F.*
Port Limon	74		12.28	6			
Zent	52	214.09	13.74	11	81.0	80.6	80.2

MEXICAN CLIMATOLOGICAL DATA.

By Señor MANUEL E. PASTRANA, Director of the Central Meteorologic-Magnetic Observatory.

April, 1903.

Stations.	Altitude.	Mean barometer.*	Temperature.			Relative humidity.	Precipitation.	Prevailing direction.	
			Max.	Min.	Mean.			Wind.	Cloud.
	Feet.	*Inches.*	° *F.*	° *F.*	° *F.*	%	*Ins.*		
Chihuahua	4,684	25.17	89.6	42.8	70.9	34	T.	sw.	
Guadalajara (Obs. del. Est.)	5,186	24.88	89.6	47.3	72.3	41	T.	se.	
Guanajuato	6,640	23.61	93.4	51.4	71.6	35	T.	sw., w.	
Leon (Guanajuato)	5,906	24.22	90.0	51.8	71.4	40	0.34	nw.	w.
Mazatlan	25	29.85	84.6	64.8	74.3	77		nw.	
Merida	50								
Mexico (Obs. Cent.)	7,472	23.02	85.1	46.4	65.5	44	0.42	ne.	sw.
Mexico (E. N. Agric.)	7,442								
Monterey (Seminario)	1,626								
Morelia (Seminario)	6,401	23.89	83.3	48.2	65.5	51	0.42	s.	s., sw.
Pachuca	7,959								
Puebla (Col. Cath.)	7,108	23.33	86.7	44.1	65.3	58	1.84	s., ssw.	
Puebla (Col. d Est.)	7,118	23.31	85.3	40.8	64.0	50	1.46	ene.	
Queretario	6,070								
Toluca	8,812	22.72	79.7	40.6	59.0	45	0.69	w.	
Zacatecas	8,015								
Zapotlan	5,078	25.02	92.1	53.2	71.6	49	T.	sse.	

*The monthly barometric means are reduced to the international standard of gravity.

XXXI–33.

Chart I. Tracks of Centers of High Areas. April, 1903.

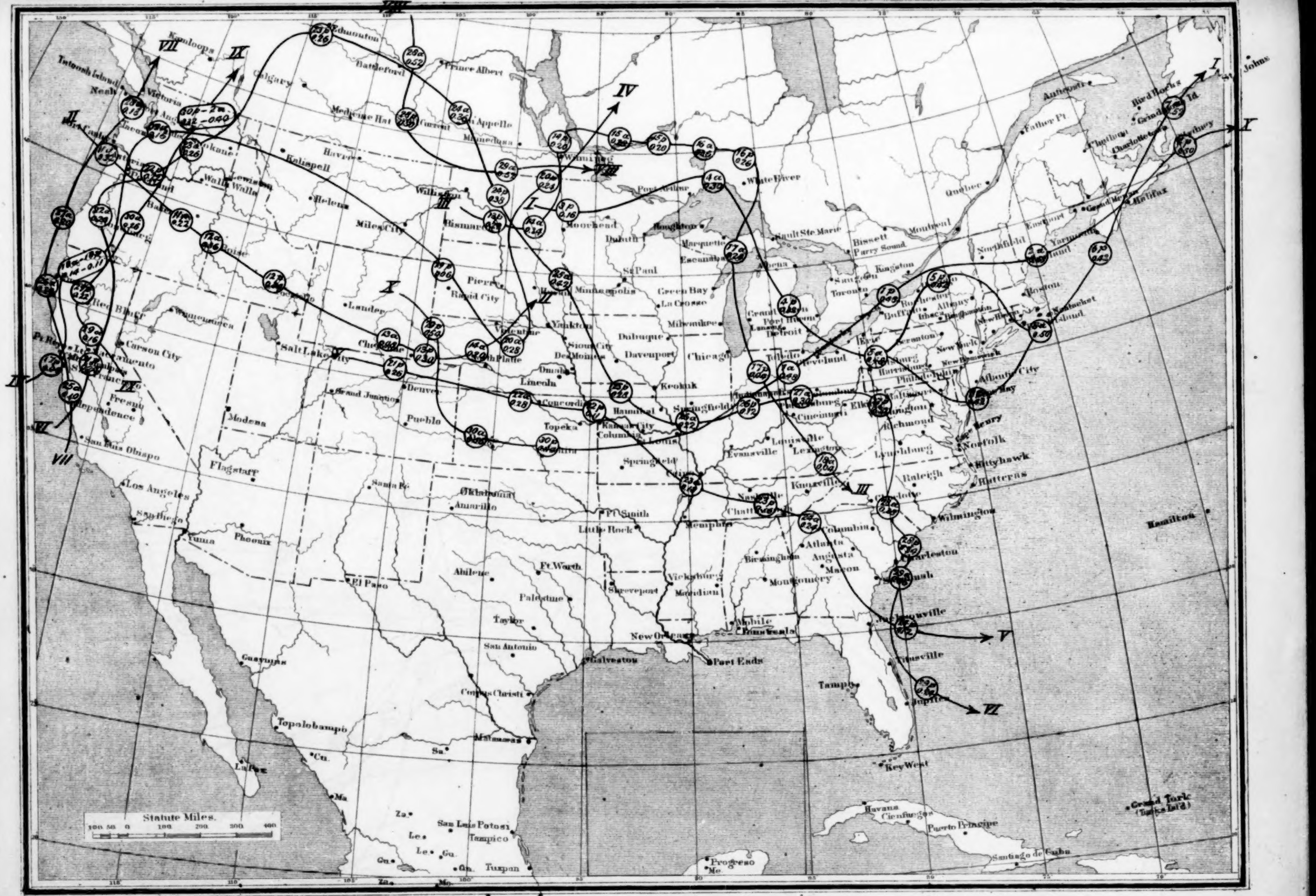


Chart II. Tracks of Centers of Low Areas. April, 1903.

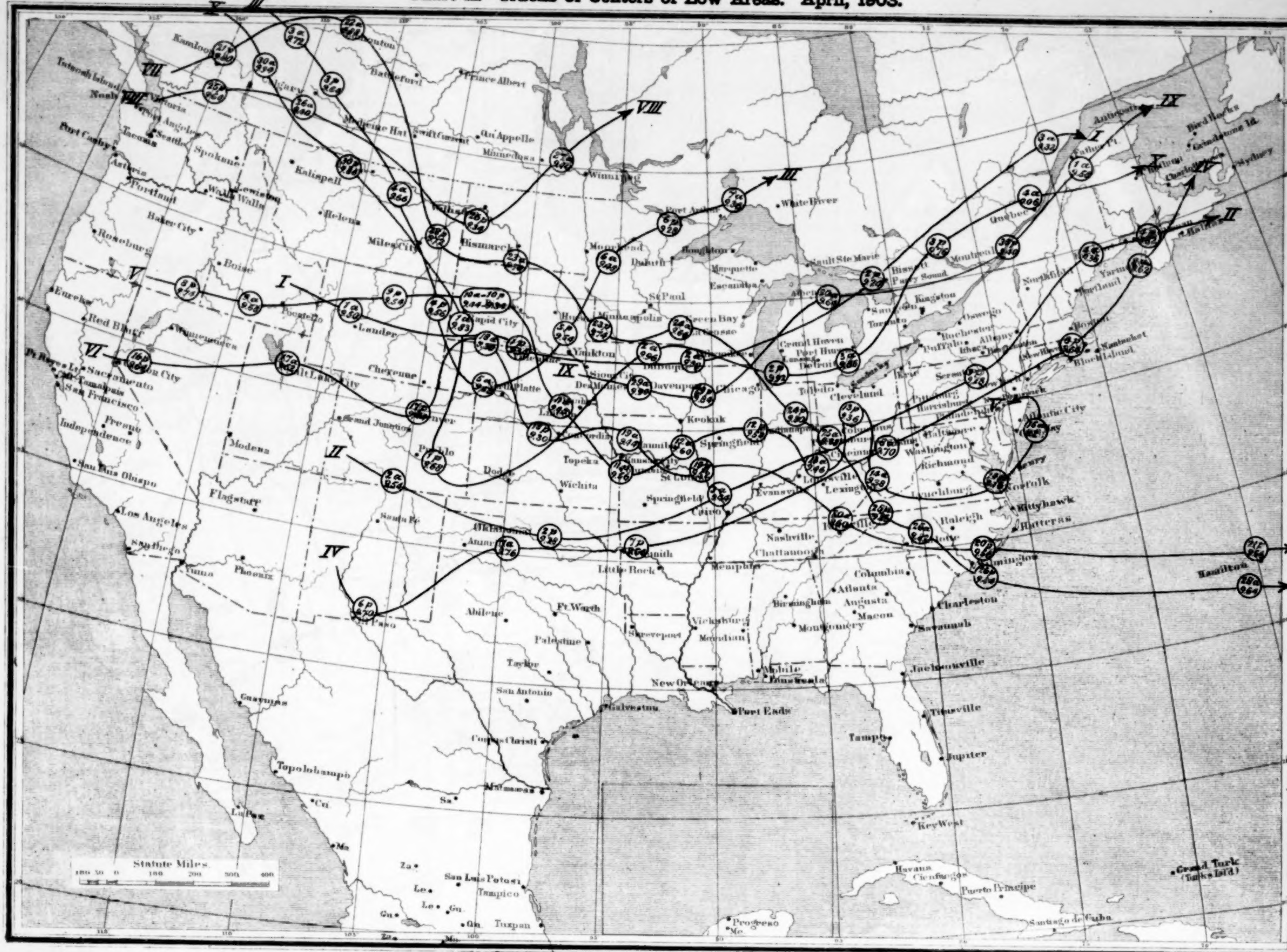


Chart III. Total Precipitation. April, 1903.

Chart III. Total Precipitation. April, 1903.

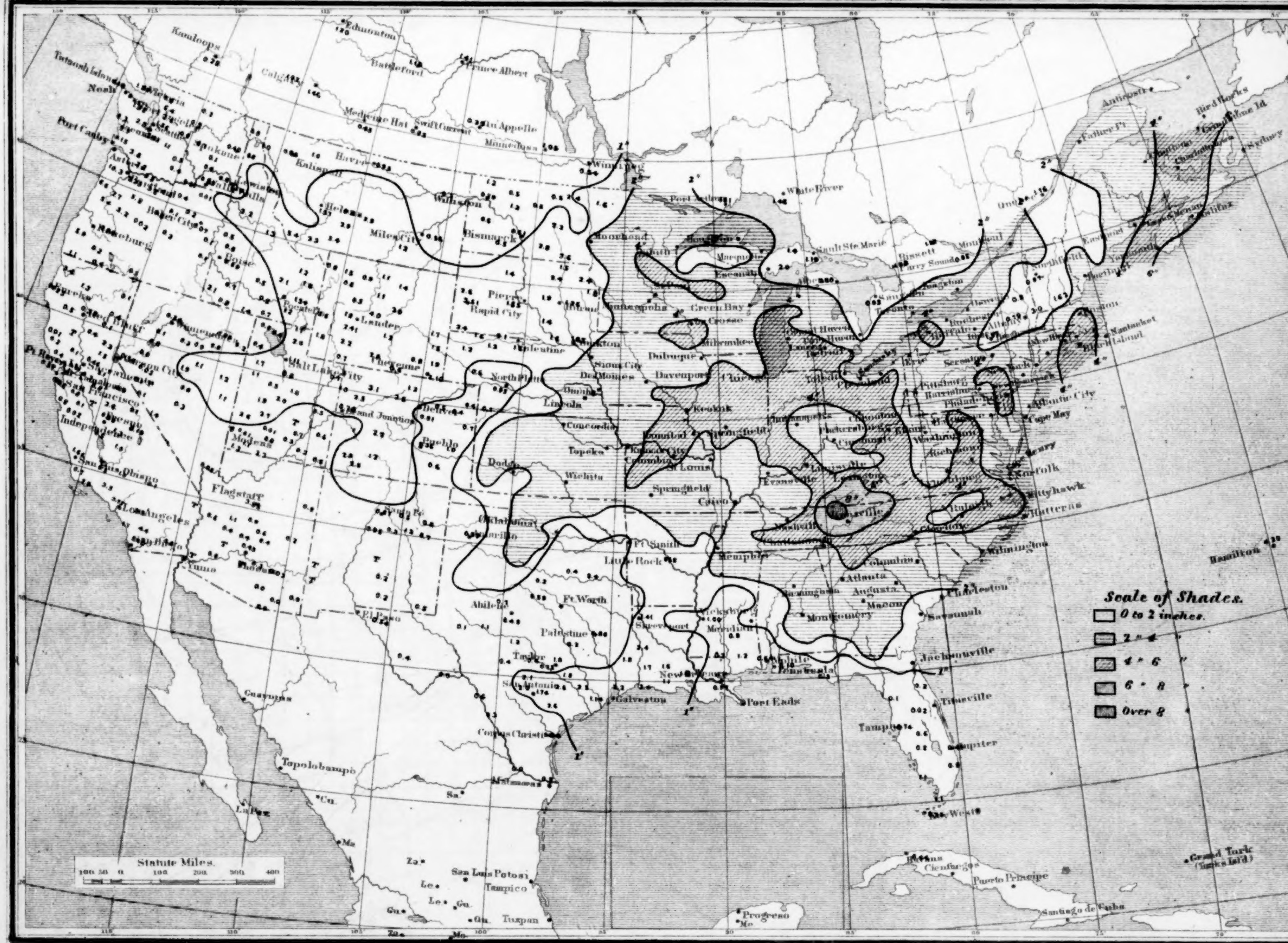
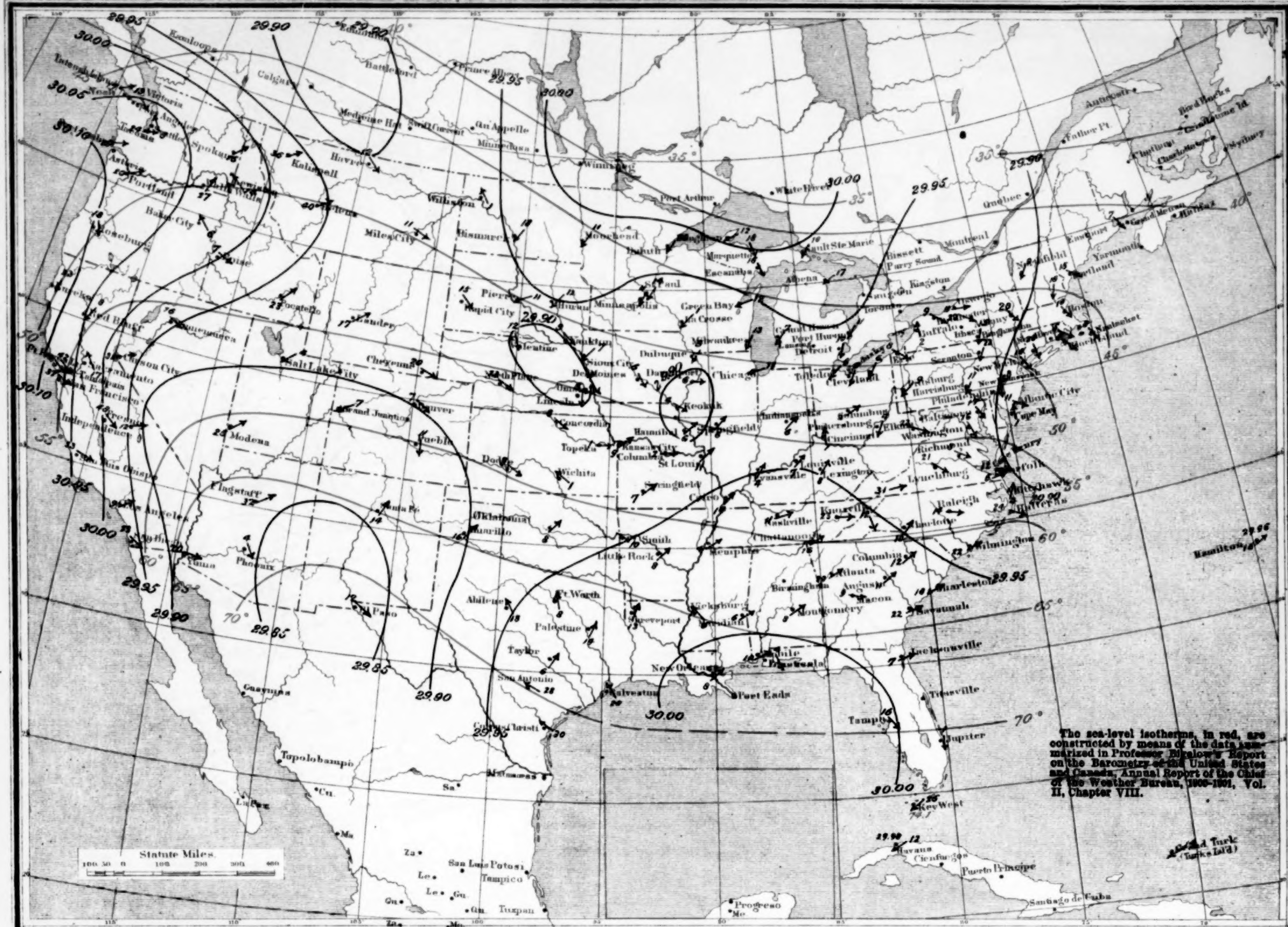


Chart IV. Sea-Level Pressure and Temperature; Resultant Surface Winds. April, 1903.



The sea-level isotherms, in red, are constructed by means of the data summarized in Professor Bigelow's Report on the Barometry of the United States and Canada, Annual Report of the Chief of the Weather Bureau, 1900-1901, Vol. II, Chapter VIII.

Chart V. Hydrographs for Seven Principal Rivers of the United States. April, 1903.

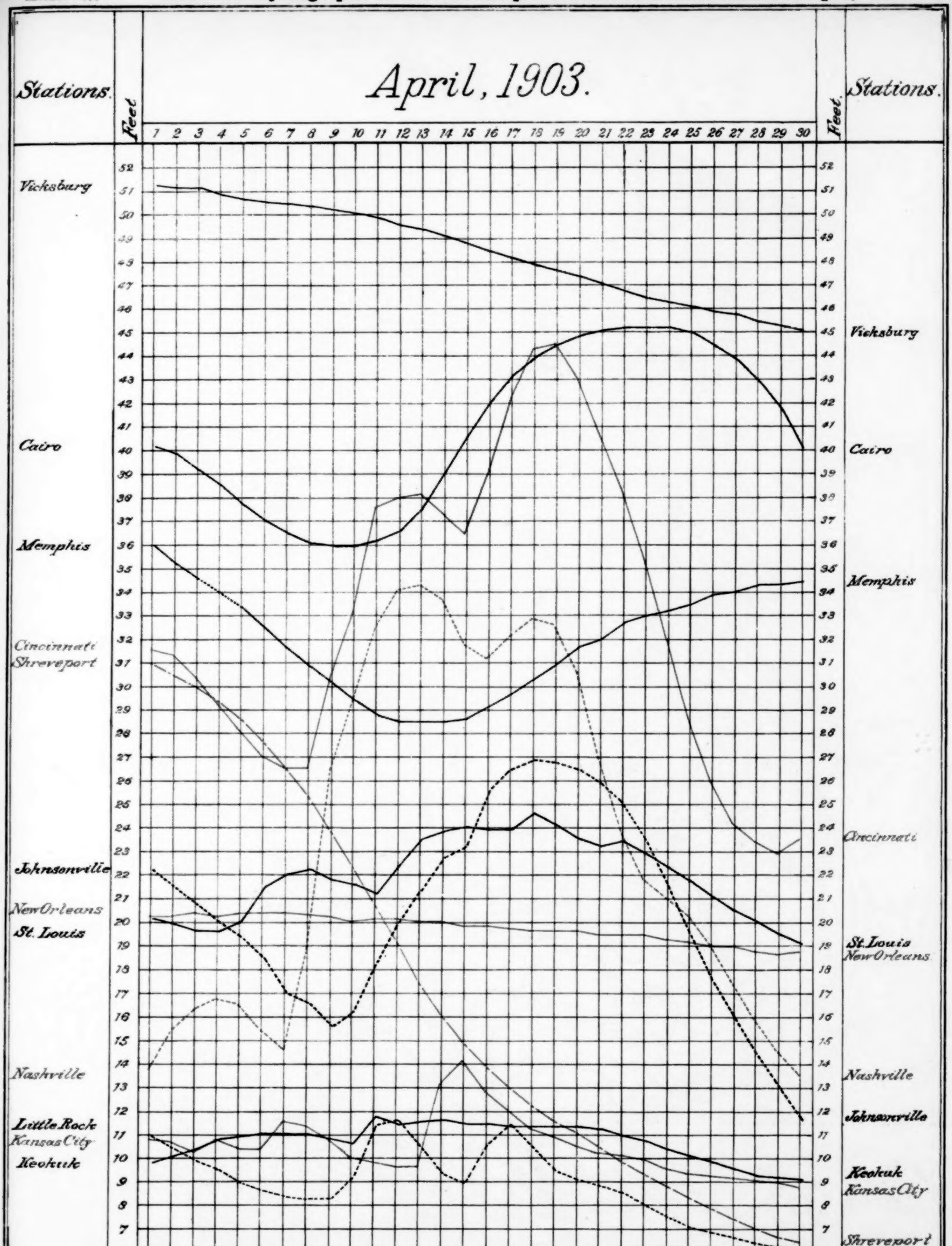
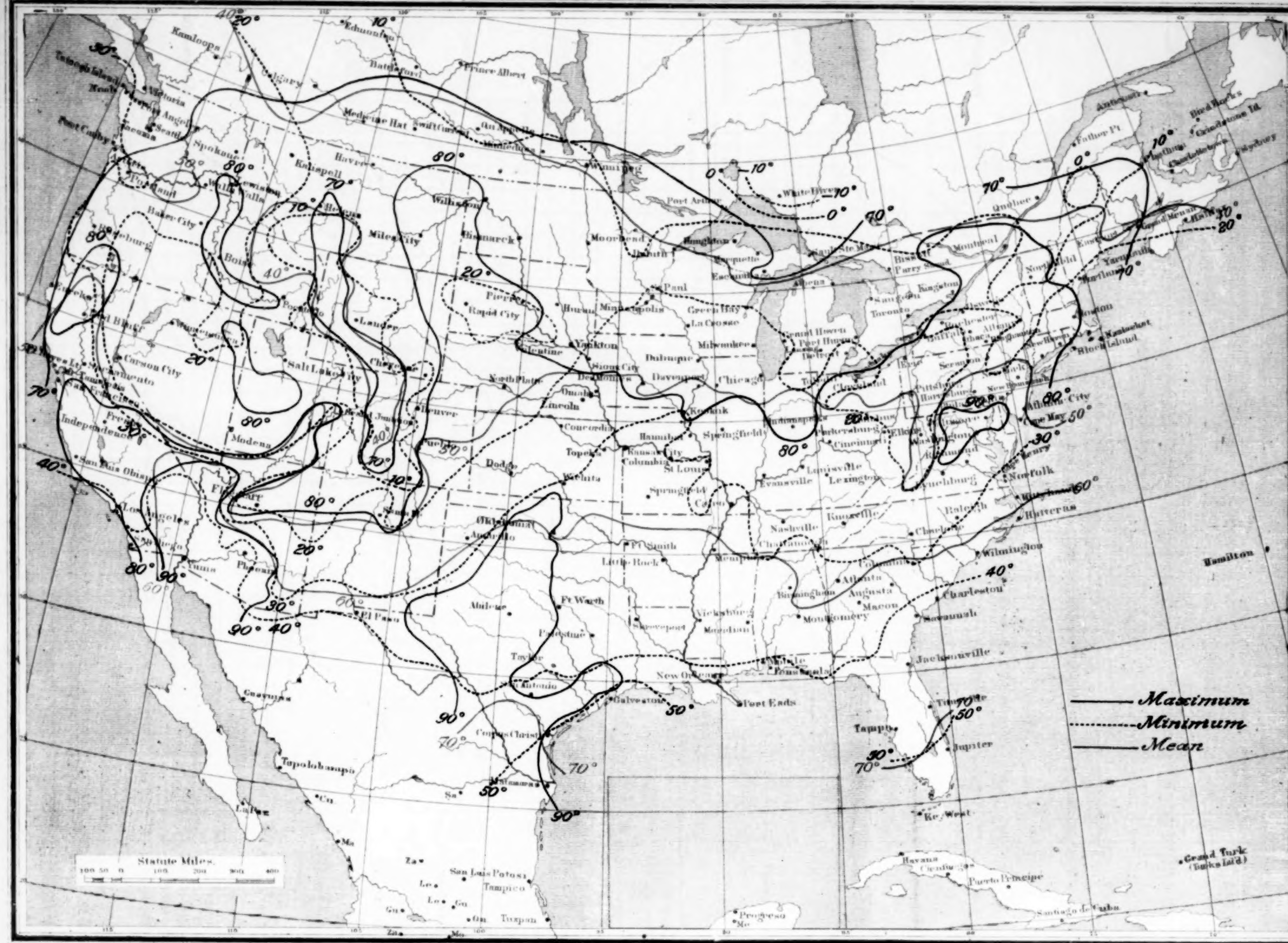


Chart VI. Surface Temperatures; Maximum, Minimum, and Mean. April, 1903.



XXXI—39. • Barkerville Chart VII. Percentage of Sunshine. April, 1903.

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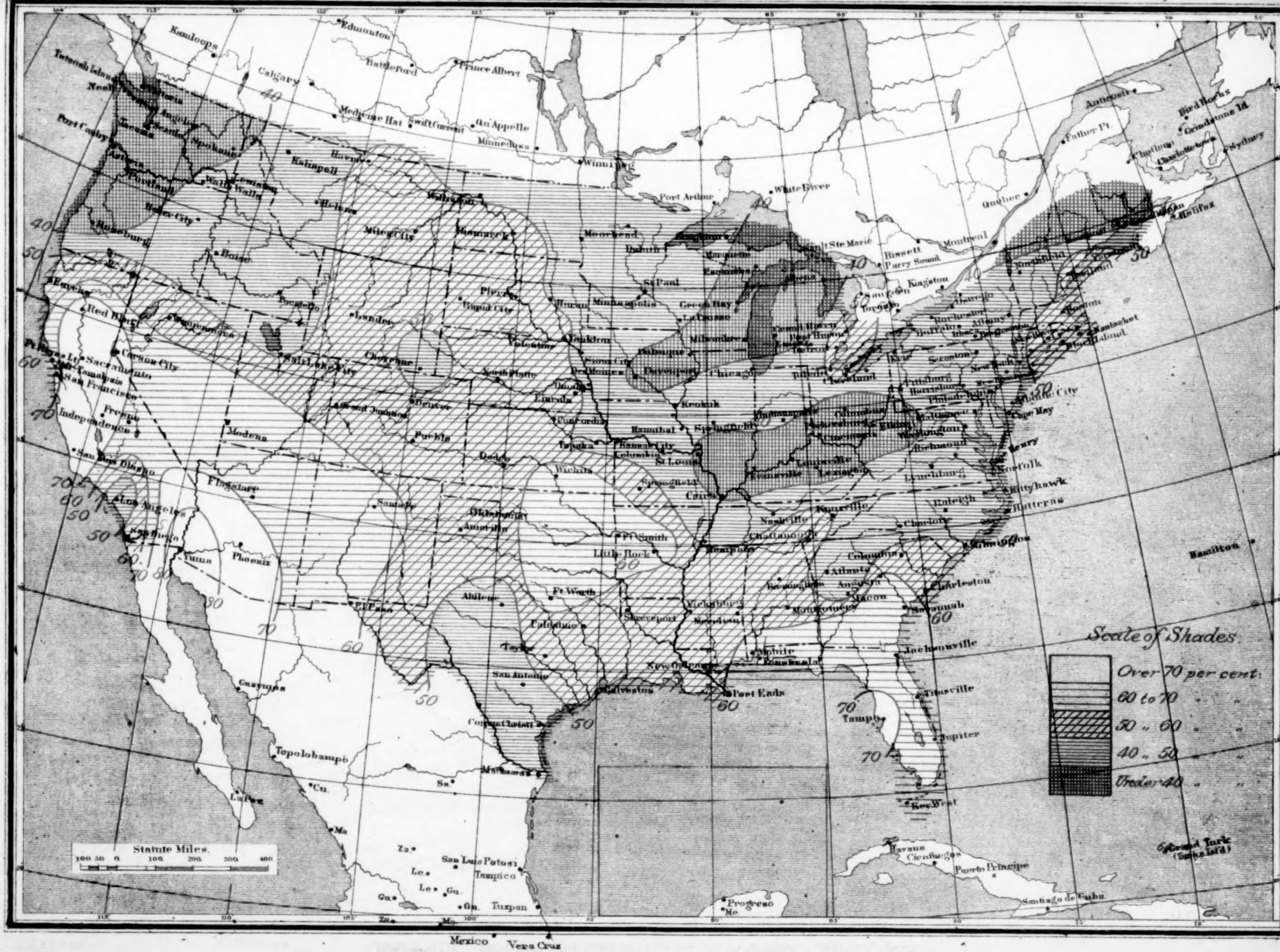

Chart VIII. Isobars and Isotherms at 10,000 feet. April, 1903.

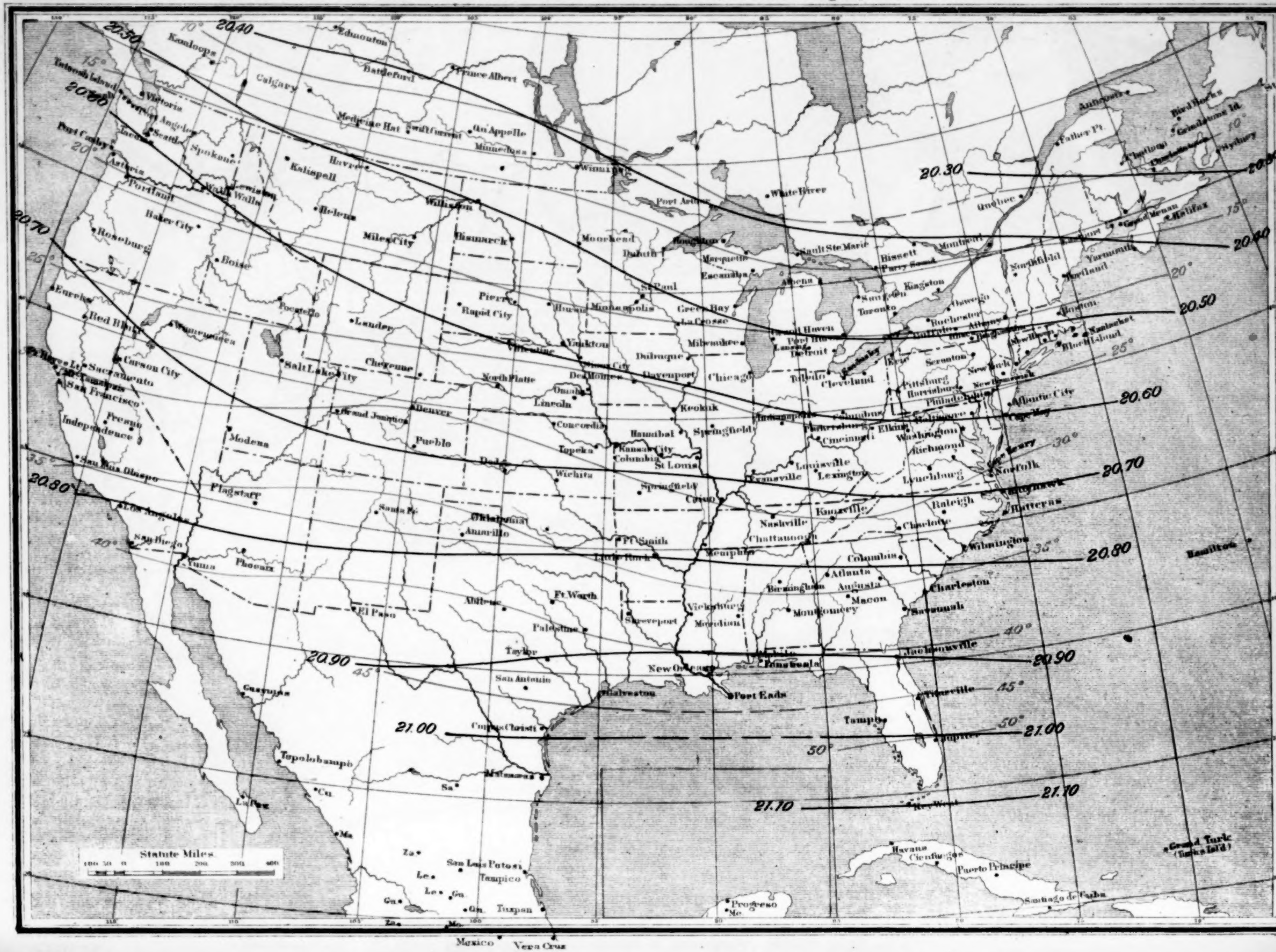

Chart IX. Isobars and Isotherms at 3,500 feet. April, 1903.

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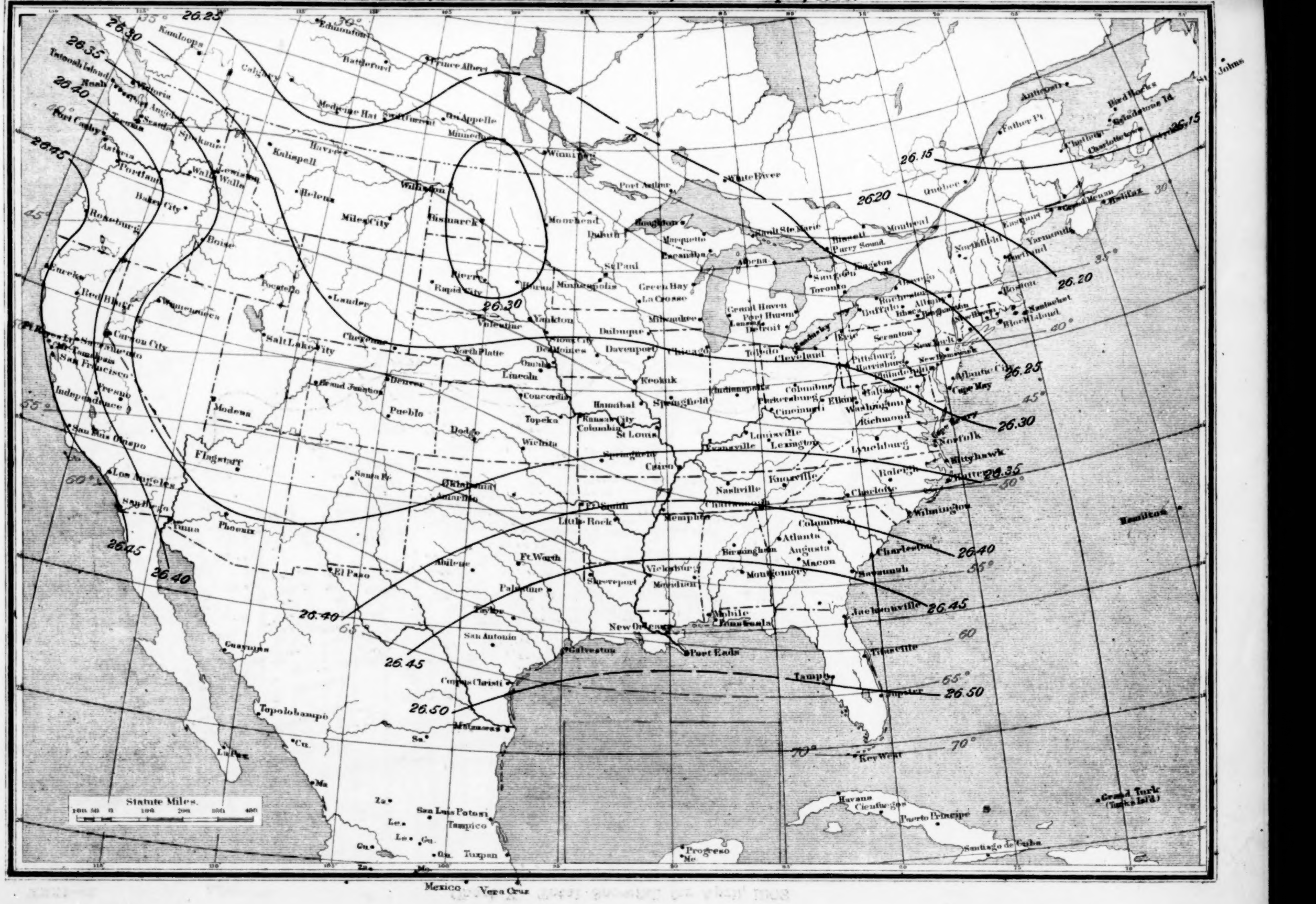

Chart X. Total Snowfall for April, 1903.